

FIRST LOOKS

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COMPUTERS

**Is Compaq's
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Systempro the
Ultimate PC?**

SOFTWARE

**Price Waterhouse
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APRIL 10, 1990

THE INDEPENDENT GUIDE TO IBM-STANDARD PERSONAL COMPUTING

VOLUME 9 NUMBER 7

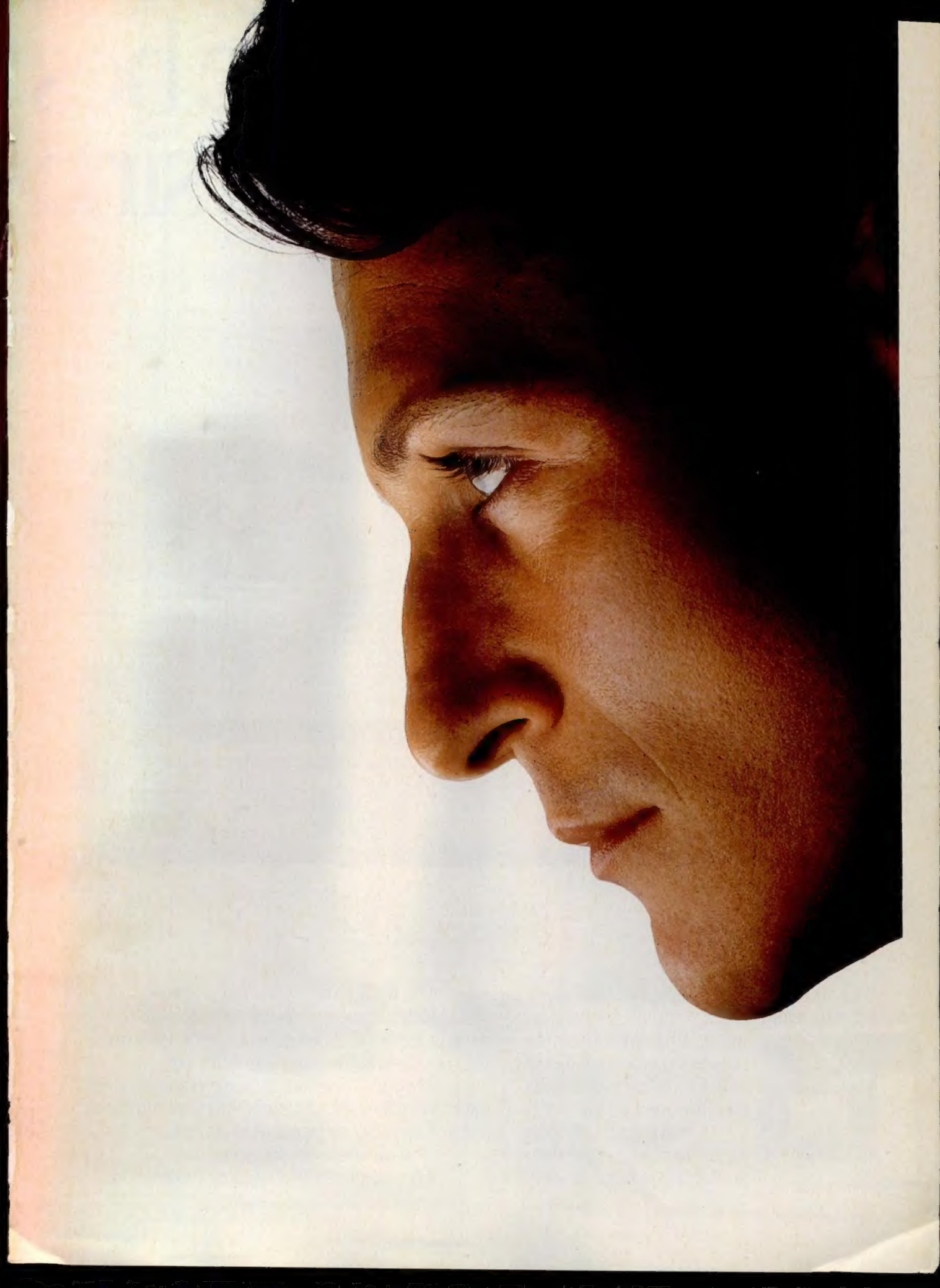
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Now, creating a table is easier than dining out. The Word for Windows table feature allows you to organize numbers, text, and graphics in a spreadsheet-like array of cells. And there's no tab.

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Chances are, those simple, everyday memos you've been creating aren't so simple to create anymore. What with the time-consuming process of messing with formatted paragraphs, typefaces, and tables.

And even if your documents aren't formatted, there's probably someone in your

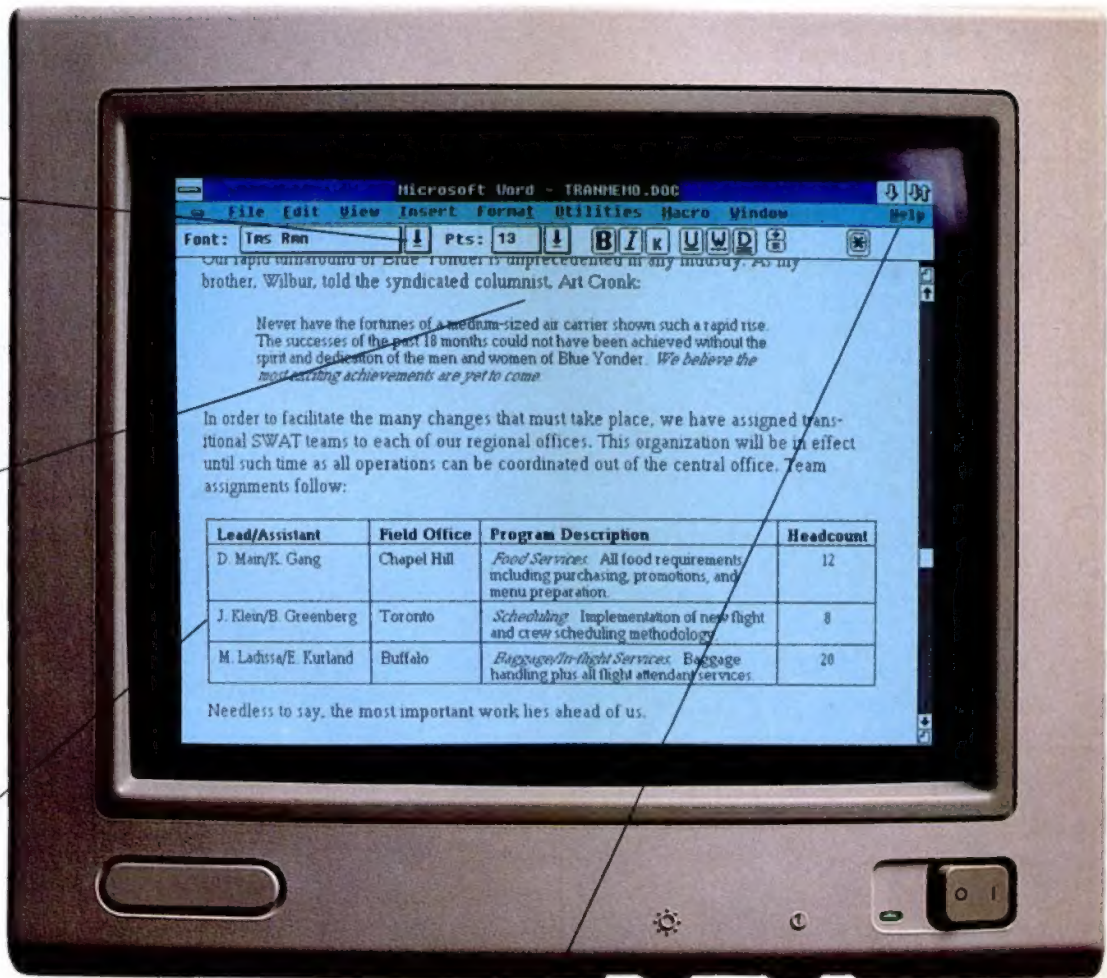
office who wishes they were. You, perhaps.

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Word for Windows' intuitive graphical user interface makes the most annoying and mundane parts of everyday memos as easy as ABC.

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Its computer-based training program and



the thing to happen to the correction key.

BLUE YONDER AIRWAYS



INTEROFFICE MEMO

To: All personnel
From: Orville Bannister
Re: Transition to passenger service
Date: November 1, 1989

Congratulations to all of you who have worked so hard over the last two years to make Blue Yonder a full-service passenger airline. The final licensing procedures were completed at 18:53 hours on October 27, authorizing us to commence passenger service immediately.

Our rapid turnaround of Blue Yonder is unprecedented in any industry. As my brother, Wilbur, told the syndicated columnist, Art Cronk:

Never have the fortunes of a medium-sized air carrier shown such a rapid rise. The successes of the past 18 months could not have been achieved without the spirit and dedication of the men and women of Blue Yonder. We believe the most exciting achievements are yet to come.

In order to facilitate the many changes that must take place, we have assigned transitional SWAT teams to each of our regional offices. This organization will be in effect until such time as all operations can be coordinated out of the central office. Team assignments follow:

Lead/Assistant	Field Office	Program Description	Headcount
D. Main/K. Gang	Chapel Hill	Food Services. All food requirements, including purchasing, promotions, and menu preparation.	12
J. Klein/B. Greenberg	Toronto	Scheduling. Implementation of new flight and crew scheduling methodology.	8
M. Ladissa/E. Kurland	Buffalo	Baggage/In-flight Services. Baggage handling plus all flight attendant services.	20

Needless to say, the most important work lies ahead of us.

Off we go!

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CIRCLE 280 ON READER SERVICE CARD

Inside

Sometimes the best changes are the ones you can't see.

In a marketplace where new products are old before they hit the shelves, consulting an industry expert can mean the difference between a dollar wasted and a dollar well spent. For that reason, *PC Magazine* has reorganized its staff in order to make each member an authority on one of five subject categories vital to your business.

Before, staffers were assigned to specific issues of the magazine and worked on groups of stories about various topics. Now each editor has been given a "beat," a subject that he or she works on exclusively.

We have divided *PC's* articles into five topics: connectivity and communications, hardware, graphics, software, and PCs. This issue's cover story on 1,024-by-768 noninterlaced color monitors and the graphics adapters that drive them is the first story engineered by a subject-oriented team. The magazine won't look any different, but with specialists preparing each article, you'll surely become even better informed.

The monitor-and-card story was put together by a pilot group led by associate editor Mary Kathleen Flynn and *PC Labs* project leader Pamela J. Milland. Before they took their permanent places on the hardware and graphics teams, respectively, their job was to iron out the wrinkles that might



appear in the team approach.

"Not only are we becoming more specialized as each of us focuses on one topic, our testing equipment is becoming more sophisticated," said Milland. "We're bringing complex new testing devices into *PC Labs* that individual purchasers can't afford for their in-house testing." The high-resolution monitors were tested using the Microvision Superspot 100, a CRT testing device used by a number of

monitor vendors to test for quality assurance.

Flynn points out that every member of the team attended day-long seminars to help them learn exactly how the monitors work and how they would be tested. "With this intimate knowledge of the technology

and testing equipment, we made better-informed journalistic decisions," Flynn said.

The Microvision tester wasn't the only piece of serious hardware in sight during the preparation of our first team-oriented story. *PC Labs* was also graced by the presence of the monolithic Compaq Systempro. And judging by the number of editors from various teams who hovered around this innovative dual-processor tower, it's clear that even the graphics and software experts can't wait to get their hands on the latest in PC technology.

—Stephanie K. Losee



PC Labs project leader Pamela J. Milland and associate editor Mary Kathleen Flynn guard the mighty Microvision Superspot 100.

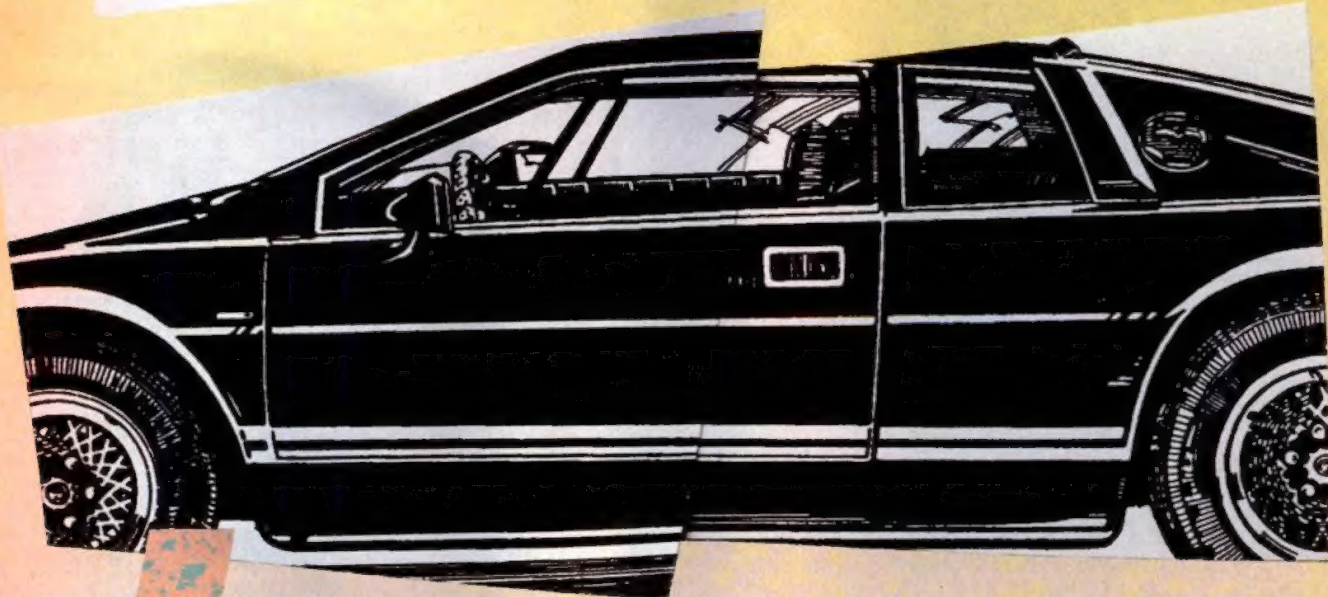
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-Publish!
November 1988

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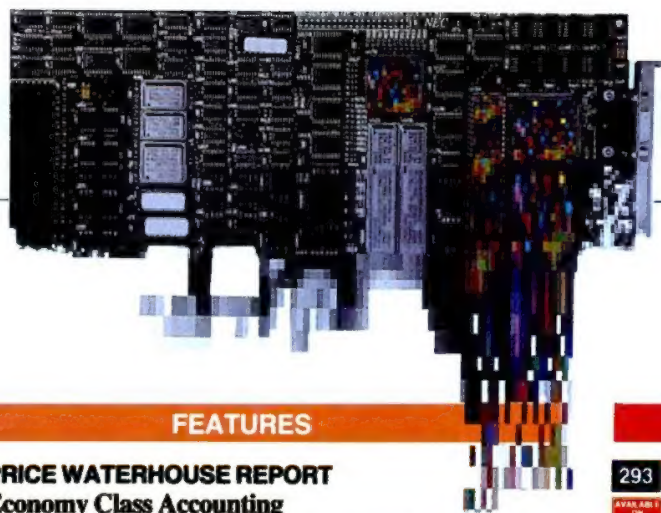
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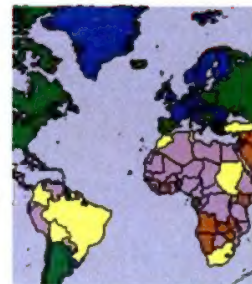
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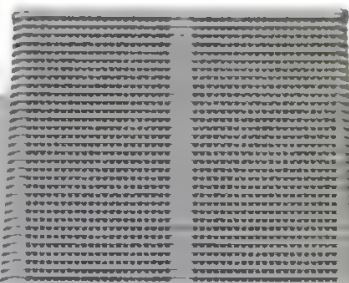
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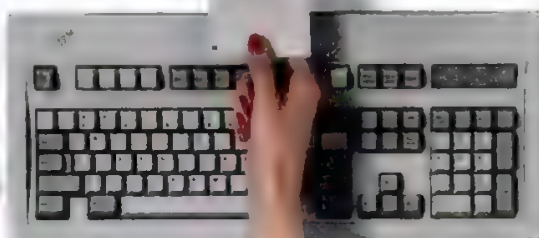
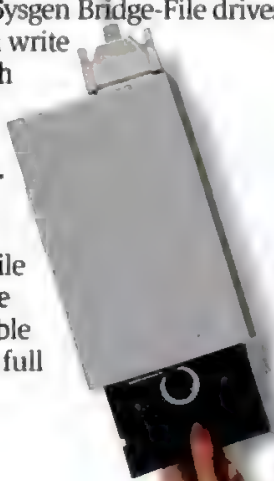
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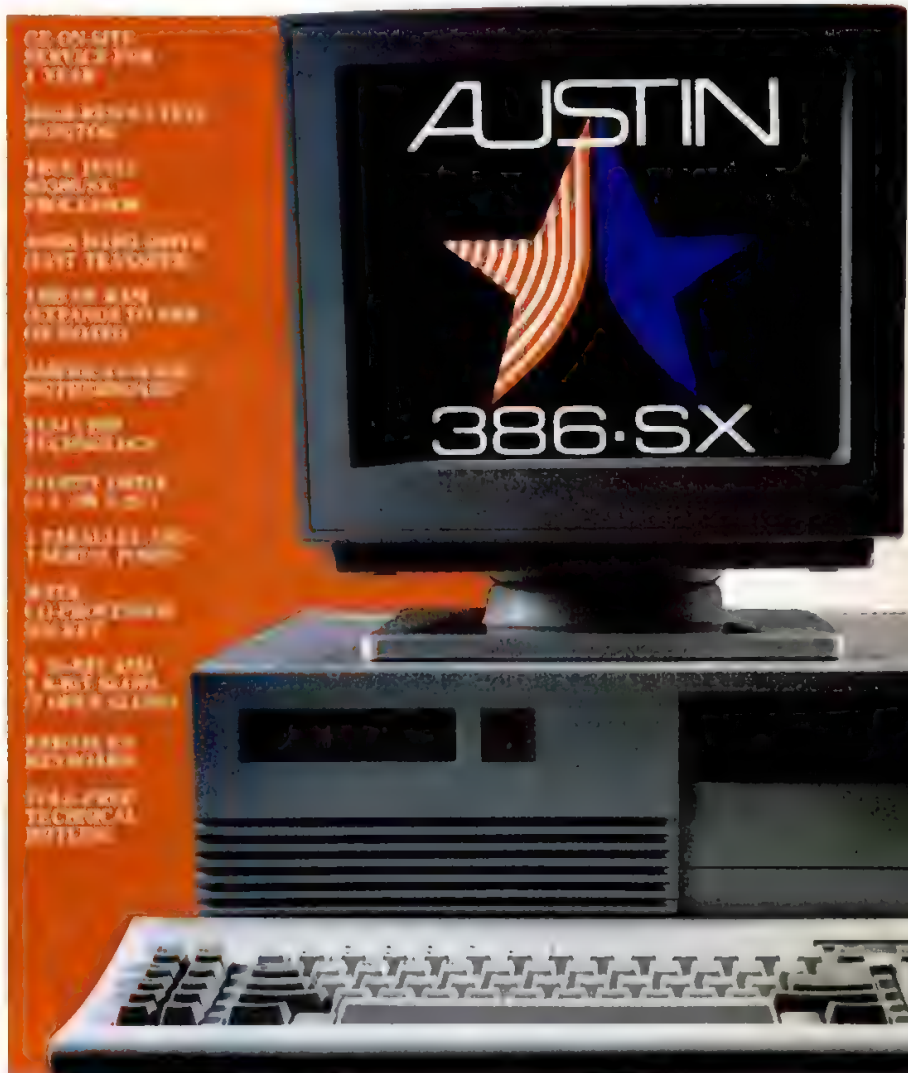
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Letters

OLD RELIABLE?

The idea of a reliability section ("PC Magazine Endurance Tests: 386s and Portables," *PC Magazine*, January 16, 1990) is a good one. Reliability is an important factor in making a purchase. But perhaps you need to define the term. To me, it means how well a product stands up to use and even abuse—how quickly things wear out, or break.

However, 80 percent of what you wrote about was compatibility problems or personal dislikes. If a mushy keyboard is too bad to use for more than a month, that's personal dislike. If a keyboard becomes mushier after a month of use, that's reliability.

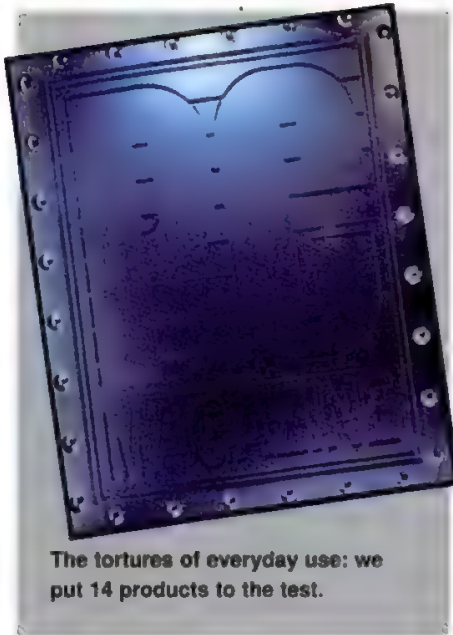
You did mention some points of true reliability: a disk drive spring going bad, a POST test finding only 128K of memory unless the motherboard is flexed, a fan motor becoming noisier, even a change in the financial soundness of a supplier. These are valuable, though the fact that they usually represent one machine's performance is a well-noted caveat. When possible, it would be helpful to mention how a group of similar machines performed—especially if they all had the same problem.

John Seiffer
Plano, Texas



We agree that reliability is an important factor in making a purchase decision, and certainly it was an important consideration for our endurance tests. However, it was not the *only* consideration—compatibility issues and performance were also factors that required consideration.

The major intention of these endurance tests is to bring out the good and bad features that would benefit or trouble most users similarly. Later this year, *PC Magazine* will devote a single issue to the service and reliability question. In that issue, we will provide statistically valid information on the reliability of various PCs and their subsystems—information



The tortures of everyday use: we put 14 products to the test.

that can't be gleaned from the experience with one particular sample.—Ed.

COMING TO A GUI NEAR YOU

Thanks for the penetrating review of *Amí Professional*, Samna Corp.'s new high-end Windows-based word processor (First Looks, *PC Magazine*, January 16, 1990). Your review has confirmed my suspicion that this program represents a very attractive migration path from character-based to graphics-based high-end word processing.

Now that word processing has safely arrived in the *Microsoft Windows* environment, along with most other applications, it appears the time may finally be right for PC users to move to the graphical user interface en masse. With *Windows 3.0* on the way, it seems that an economical and comfortable stepping stone from DOS to the OS/2 Presentation Manager is in the making. I'm sure that a year from now, *Amí Professional* and other top-flight *Windows* applications will be available for PM, as well. On the other hand, it looks like *Windows* is not going to be such a bad place to hang around for a while, either.

So, users are going to have what they have always enjoyed most: a choice. Oh, boy!

Bob Vincent
Atlantic Beach, Florida

DIMINISHING RETURNS

As a very satisfied user of *PRD+*, I both agree and disagree with Bill Machrone's comments in the January 16, 1990, issue.

Yes, if you try to boost your typing speed to "200 or more words per minute" by abbreviating every phrase you might ever use, you will spend more time trying to remember your abbreviations than you will save in typing. But I have found that if I limit myself to 30 or 40 abbreviations for the most commonly used words and phrases, I gain a solid 10 percent increase in typing speed. That's not spectacular, but it's not bad, either.

Jock K. Chung
Washington, D.C.

IT'S IN THE WAY THAT YOU USE IT

I feel that I must take issue with John C. Dvorak's belief that voice-mail systems are the "biggest plague on the land" (John C. Dvorak, *PC Magazine*, December, 26, 1989). At my company—a manufacturing firm with more than 1,200 employees—we have been using voice mail for several years and have found it to be a wonderful tool for getting in touch with hard-to-catch people.

I submit that the real "plague" is caused by users who expect technology to solve their problems. Voice mail, like so many other products, is only a tool that can help a business succeed; success or failure is directly determined by how that business uses the tools available. The key to a successful voice-mail system is for the users to respond to their messages. If a company is "too busy" to return a voice-mail message, it probably wouldn't return a handwritten message, either.

Dennis Weatherly
Auburn, Washington

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Letters

We are as confounded as John C. Dvorak by the way in which many companies use voice mail. I too become infuriated whenever I'm forwarded to a voice mailbox and not given the opportunity to reach a live person.

Too many companies install voice processing for the wrong reasons—staff reductions, quick fixes, and personal convenience. But a voice-mail system installed with the express intent to better serve the customer will eliminate the problems Mr. Dvorak relates and can actually promote person-to-person contact and strong customer relations.

We recommend that the first line of call handling not be a machine, but a highly trained receptionist who always answers the main phone number listed. Another line should be reserved for frequent callers and internal use—for those who opt to bypass the receptionists and get in touch directly or leave a personal message. Mr. Dvorak's personal preferences aside, there are many who prefer the speed, accuracy, confidentiality, and dependability of a personalized voice-mail message over a receptionist's While You Were Out slip. If a company's main objective in installing voice processing is to save itself the money or inconvenience involved in answering the phone, it's likely to lose much more in the long run. Caller care is the key to voice processing, and you can build that into your company with the careful combination of the best technology and people.

Ellen Pensky

Director, Marketing Communications
VMX Inc.

San Jose, California

■ A THOUSAND POINTS OF LIGHT

John C. Dvorak is right on when he says our industry needs the leadership once provided by Don Estridge (John C. Dvorak, *PC Magazine*, January 16, 1990). One could get the feeling IBM led us into the land of MCA, then curtailed development to slow the growth of PCs—thus protecting its mainframe dinosaurs. But the PC market is much bigger than the mainframe market. It's time IBM stopped listening to Wall Street's mistaken view that the company has a sales problem. What IBM needs to do is to develop some better mousetraps.

MCA caused a great rift, as though

from a giant earthquake. This brought out a flood of leadership like the leadership John saw in the San Francisco earthquake. One large group quickly identified the need for an AT bus extender and went to work on EISA. Peripheral houses needed a standard interface, and so added the kind of SCSI adapters they were using on Macs and workstations to PCs and PS/2s. This allowed people to get rolling on better hard disks, laser disks, DATs, fiber-based LANs, and a raft of other technologies whose markets had been sup-

Mr. Dvorak's personal preferences aside, there are many who prefer the speed, confidentiality, and dependability of a personalized voice-mail message over a receptionist's While You Were Out Slip.

pressed by the unavailability of common attachments. EISA and SCSI, when added to Intel's and Microsoft's foundations, have democratized the PC.

I believe we finally have outstanding leadership. From now on IBM can only make positive contributions to the technology—for it no longer has the power to slow things down.

George H. Thompson
Boulder, Colorado

■ THE SOUNDS OF MUSIC

In the December 26, 1989, Advisor column, a reader asks about the music cards and software that would be compatible with the newer Sierra On-Line adventure games. In her reply, Lori Grunin mentions a number of products, including the Roland MT-32 and the Ad Lib music card. While I agree with Ms. Grunin that the Roland is the best choice for serious listeners or composers (she also notes

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Takes the wait out of Windows!

Letters

that it's serious money, about \$600), it should be noted that one critical shortcoming of the Ad Lib card was not mentioned—namely, that it produces only monaural sound, not stereo.

In this age of digital recordings and compact disks, most of us want a reasonably priced, stereo alternative. I think Creative Music Systems has really come through with its Game Blaster card and software. Available as a package for under \$300, the Game Blaster offers full stereo sound and 12 voices. You can also use it to write your own music.

James K. Goltz
Edwardsville, Illinois

NO LAUGHING MATTER

I was amazed to read Tom Unger's review of Electronic Arts' *688 Attack Sub* (After Hours, *PC Magazine*, December 12, 1989). Nowhere in the article did it mention that the 688-class submarine launches nuclear weapons.

While this software is certainly obnoxious, the review didn't improve the matter any. The worst part: "Imagine your total satisfaction as you coolly pump some high-explosive vengeance into his hide ... that kind of satisfaction ought to be worth fifty bucks."

Antisubmarine warfare is more dangerous than any other type of nuclear war strategy, since it is the most obvious first strike (due to the inherent technical problems of communicating with submerged submarines). Please, devote your talents and energies toward helping people ensure the earth's survivability, and not its destruction.

Mark Robinowitz
Takoma Park, Maryland



We hope that the majority of our readers understood the nature and intent of Mr. Unger's deliberately exaggerated tone in the review cited by Mr. Robinowitz.—Ed.

OBSOLESCE? MAYBE; OBSOLETE? NO WAY

I purchased another 286-based PC this week. While doing so I recalled the many reasons for not buying one that I have read in your magazine. Bought it anyway.

While none of your pro-386 arguments are incorrect, they are incomplete. That's

why the market says that your reports of the 286's demise are greatly exaggerated. Today's problem buys today's computer. Today's computer uses today's applications on today's peripherals at the lowest cost. Granted, tomorrow will inevitably come, but there appears to be no evidence that the 386 is tomorrow's answer, either.

Why pay the extra costs of the 386? Why wrestle with measuring the different memory-caching schemes against each other? Why gamble on which I/O bus will become a standard? Just to run MS-DOS applications under OS/2 in its present "Big Dummy" state? Or to wait for another generation of software and peripherals to catch up? I don't yet see a 386 difference that contributes to the bottom line.

Milo L. Hurley, Jr.
Aurora, Colorado

TOSHIBA: THE LOVE BUG?

The Toshiba T1000 is hardly the "Model T of laptop machines," as characterized by Rock Miller ("*PC Magazine* Endurance Tests: 386s and Portables," *PC Magazine*, January 16, 1990). Radio Shack's Model 100 is the Model T. The T1000 is, of course, a Volkswagen Bug.

Mari J. Stoddard
Nashville, Tennessee

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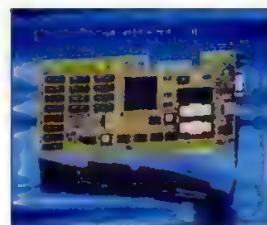
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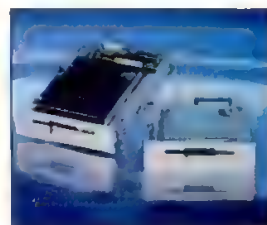
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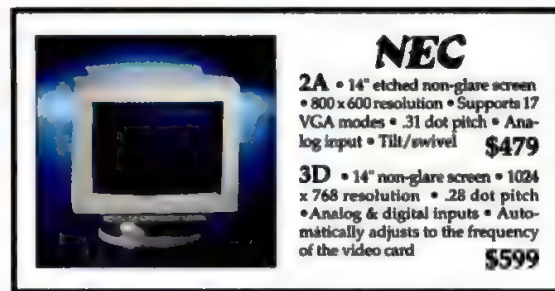
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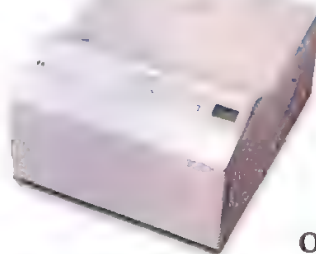
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Advisor

QUICKEN CHECKS

I recently purchased *Quicken*, Intuit's financial program. *Quicken* is everything that I expected, with one exception: the blank checks needed to take advantage of check printing—one of *Quicken*'s most useful features—seem too expensive. Intuit's QuickChecks kit, which includes 500 checks and 500 envelopes, for example, starts at \$83.90 for the wallet-size checks; that's more than twice the street price of the program itself and doesn't even include the cost of deposit slips (another \$14.95). It's like the old ploy of giving away free flour but charging the buyer \$2 each for the sacks in which to carry it away.

Are there other companies that print compatible checks but don't charge as much money?

Jon Lindsey
Memphis, Tennessee



There are two companies that print compatible checks for *Quicken* (\$59.95; Intuit, 540 University Ave., Palo Alto, CA 94301; (800) 624-8742, (800) 468-8481 in Calif.), but only one offers the products at consistently lower prices.

NEBS Computer Forms (NEBS Inc., 500 Main St., Groton, MA 01471; (800) 225-9550) manages to slightly underprice Intuit for most of the *Quicken*-compatible accessories, but doesn't offer as broad a selection of products as Intuit. You may also recognize the name of Deluxe Computer Forms and Supplies (1275 Red Fox Rd., P.O. Box 64046, St. Paul, MN 55164; (800) 328-0304, call collect (612) 631-8500 in Minn.), the printing company used by many banks for their checks. Deluxe's prices are about the same as Intuit's, however, and its selection narrower than NEBS's. The check prices are slightly higher; for instance, 500 of Deluxe's standard-size one-part checks go for \$59.95, in contrast to Intuit's price of \$55.95 and NEBS's least-expensive \$49.95. On the other hand, Deluxe's

- **QUICKEN CHECKS:**
Alternative sources for *Quicken*-compatible accessories.
- **WHAT'S IN BACKUP.00?, ANYWAY?**
Keeping track of your DOS BACKUP disks.
- **SWAPPING A: AND B:**
Dealing with programs that demand a floppy disk in drive A:

windowed-envelope prices are the lowest—\$28.70 for 500 as opposed to Intuit's \$36.95 and NEBS's \$29.95. If you buy both checks and envelopes, the totals come to \$79.90 for NEBS, \$88.65 for Deluxe, and \$92.90 for Intuit.

As for deposit slips, Deluxe charges \$15.50 for a 200 pack, comparable with Intuit's \$14.95 offering and NEBS's whopping \$21.50. But you needn't buy the deposit slips from any of these companies: the slips don't go through your printer, so you can stick with the less-expensive ones your bank offers.

It may be small consolation, but remember that although all of these companies' check prices might seem high, these accessories are really considered to be computer forms rather than checks, and are therefore bound to be more expensive.

WHAT'S IN BACKUP.00?, ANYWAY?

When I back up files to a floppy disk using DOS 3.3's BACKUP and then take a directory of the disk, it doesn't tell me which files are stored on the disk, as previous versions of BACKUP did. Furthermore, if I try to do a RESTORE to the hard disk and don't tell the program

what subdirectory the files came from originally, it will not restore anything.

How can I find out what is on the floppy? And how do I best restore anything from a backup diskette when I don't know where it came from?

Armin Kleinfelder
Daytona Beach, Florida



For BACKUP disks that you've already created, you can use a shareware utility called BDIR (minimum \$1 payment to author; available as BDIR.ZIP in Data Library 1 of the IBMSYS Forum on CompuServe or contact the author through the support bulletin board at (919) 471-6026. To decompress the file, you can download DEZIP2.EXE from Data Library of IBMSYS or you can use any zip file unpacker).

BACKUP stores the file and disk information in a file called CONTROL.00? (where the ? corresponds to the sequential number of the BACKUP diskette). BDIR uses this information to display an on-screen list of the files, complete with pathnames for each disk you scan. RESTORE won't work unless you specify a pathname; to the program, the path is *part* of the filename—that's the way the information is recorded by BACKUP.

When using BACKUP in the future, you have a couple of ways to create a listing of the files stored on each diskette. For a hard-copy list, hit Ctrl-PrtSc before starting the backup process; this will send a copy of screen output—BACKUP's display of the files as it processes them—to the printer. When you're finished, hit Ctrl-PrtSc again to turn it off. Alternatively, use the /L switch on the BACKUP command line to create a log file of your backup session. You can find an explanation of BACKUP's switches in most DOS reference books. (Some suggested editions appear in the Advisor column in the November 28, 1989, issue of *PC Magazine*.)

Advisor

One further suggestion: it might be worth your while to get some real backup software. While DOS BACKUP might seem perfectly serviceable, the healthy collection of third-party alternatives suggests that many people are disenchanted with it. Backup software packages give you more control over various aspects of the backup process, and they offer file compression to minimize the number of floppies it requires. Once you've stopped using BACKUP, you'll never want to go back.

The last time we looked at backup software, *Fastback Plus* (\$189; Fifth Generation Systems Inc., 1120 Industrious Blvd., Baton Rouge, LA 70809; (800) 873-4384, (504) 291-7221) and *Intelligent Backup* (\$149.95; Sterling Software, 202 E. Airport Dr., #280, San Bernardino, CA 92408; (800) 328-7463, (714) 889-0226) earned our Editor's Choice, but there are less-expensive options as well.

For additional information about

backup software packages, take a look at "Backup Software: For the Moment After" in the August 1989 issue of *PC Magazine*.

SWAPPING A: AND B:

I have a machine with a 3.5-inch drive designated as A: and a 5.25-inch floppy drive as B:. Although I have installed a copy-protected game of mine on my hard disk, it always checks for the original 5.25-inch disk in A:. Is there any way to prevent this from happening?

Steven Weelborg
Gulfport, Mississippi



Without playing with the code, there's no way to prevent the program from always looking for the disk in drive A:. You can, however, fool the machine into thinking drive B: is A:, and vice versa.

Before all else, you might want to try the DOS commands ASSIGN A=B or SUBST A: B:\. These work occasionally, but not always. If they don't work for you, then your software option is *B:Boot!* (\$19.90 plus \$2 shipping and handling; YWSoft, P.O. Box 2231, Bloomington,

IN 47401; (812) 857-4772).

You stick the *B:Boot!* disk into drive A: and a bootable DOS diskette into drive B:, then reboot the computer. *B:Boot!* forces the machine to boot from the B: drive, and from then on the machine recognizes the two drives as reversed. *B:Boot!* is the only way to go if your games require that you boot from the game diskette.

With any of these methods, I recommend that you perform them just prior to running your game and reset the system to its normal state as soon as you are finished—especially if you're going to be performing any disk operations. Under these circumstances, a (human) memory slip could result in the deletion of important files; furthermore, you don't want to take the chance of confusing your disk controller.

ASK THE ADVISOR

Send your questions to Advisor, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see the "By Modem" sidebar in the Utilities column for access information). Please specify your equipment. ■

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"Quicken slashed my tax preparation time and cost by 70%..."

—K.C. Branscomb, President, IntelliCorp

As tax time approached, I used to get this knot in my stomach. I'd dread getting all my receipts and records together for my accountant. I had this nagging fear that I couldn't find all my backup material. But not any more, thanks to Quicken.

It used to take me several weeks to prepare for my taxes. Now, with Quicken, I'm done in a few hours. And since Quicken does all the organization and calculations, pulling together the data for my personal Form 1040 and Schedules A, B, C and D is simple. What's more, my accountant's bill is 70% less because my Quicken records are so complete.

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I used to worry about being audited. When it actually happened, boy was I nervous! Not because I'd done anything wrong, but because I knew I'd need very detailed records. So, I went into the audit armed with Quicken, both in reports and on my laptop. Sure enough, the IRS agent questioned every expense—every trip I took, every hotel room I stayed in. Thanks to Quicken, I responded to each inquiry quickly and easily. My accountant said that being so organized made

all the difference. And when the audit was over, it turned out the IRS owed me money!

"Quicken saves me time all year long"

I used to spend 3 to 4 hours every other Saturday writing checks and doing the books for my home and consulting business. Since discovering Quicken, I get the job done in just 30 minutes. All my frequent transactions are memorized on Quicken, so I just push a button...and Quicken writes, categorizes, and records my payments and deposits. It even prints checks for me. That frees up time for golf, skiing, and friends.

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Before being president of IntelliCorp, I ran my own consulting business. So, I know how Quicken saves time with both personal and business finances. You just enter transactions, and Quicken automatically puts them in order and does the math. It captures your data in one place, and creates valuable reports like budgets and net worth statements in less than 3 seconds. For small businesses, Quicken creates P&L's, Cash Flows, Balance Sheets, and other reports.

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PC Magazine, May 30, 1989

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First Looks

Hands-on Reviews of the Latest Products

HP LaserJet III Battles PostScript Printers with Scalable Fonts, Enhanced Resolution, and Low Price

Not since the Hewlett-Packard LaserJet Series II replaced the LaserJet Plus has there been such a leap in printer functionality coupled with a significant drop in price. HP's LaserJet III incorporates all the benefits of add-on products you might have or wish you had for your Series II: scalable fonts, the ability to use landscape and portrait type on the same page, enhanced resolution for text and line art, vector graphics for faster drawings, more memory, and even the ability to print text on an angle. All this (and more) costs \$2,395—\$300 less than the list price of Series II.

Of the LaserJet III's dozens of new features, the most significant is HP's Resolution Enhancement technology. It may well have the add-on controller manufacturers on the run in short order.

The LaserJet III is based on the same 8-page-per-minute Canon SX engine as the Series II and delivers the same 300-dot-per-inch resolution. Resolution Enhancement technology allows the LaserJet III's controller to play with those 300 dots—with extraordinary results. Along the horizontal axis, the controller modulates the laser beam so that it can print the dots at any of five sizes, ranging from 20 percent to 100 percent of normal size. Furthermore, it can station the dots at the bottom or top of the normal print position, thus all but eliminating jagged edges, for nearly horizontal lines.

Near-vertical lines are treat-



The HP LaserJet III uses PCL 5, a new version of the LaserJet command language that supports scalable fonts.

ed differently, but to similar effect. The controller can calibrate the timing of the laser beam so that dots are placed to the right or left of their normal

positions. The net result: incredibly smooth text and line art. Small, italic fonts are transformed from ugly squiggles to well-defined characters that be-

Paradox Engine Offers Industrial-Strength Database Library to C Developers

HANDS ON
by Richard Hale Shaw

Borland International's *Paradox Engine*, a database library for C programmers, lets your applications tap the power of *Paradox*. Extracted from the core of Borland's relational DBMS, the \$495 *Paradox Engine* provides C programs with the database technology found in *Paradox 3*. Since Borland has already incorporated the *Engine*

into its *Quattro Pro* and *SideKick for the Presentation Manager*, you'll now be able to write *Engine* applications that can share data with these programs, add new capabilities to them, and use them as front ends as well.

While it's a pleasant surprise to find this level of compatibility extended throughout a commercial product line, it's amazing that Borland has released the technology to developers. The

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implications of the release are considerable: if you've ever wanted to add your own extensions and enhancements to Borland products, the *Engine* provides a means of doing so. For instance, giving *Paradox* the ability to receive downloaded mainframe data or adding application-specific financial analysis capabilities to *Quattro Pro* are a natural for *Engine*-based applications; a developer can write an enhancement as a C program that uses the *Engine* to place downloaded or updated data into the appropriate table. And since the *Engine* includes a full complement of *Paradox*'s multiuser concurrency features,

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First Looks

HP LaserJet III

CONTINUED FROM PAGE 33

gin to rival the output of 600-dpi printers.

Not far behind Resolution Enhancement technology in importance is the printer's use of scalable fonts—the biggest reason that people have picked PostScript printers over LaserJets and compatibles.

Like PostScript, PCL 5—the latest version of the LaserJet command language—supports scalable fonts. The LaserJet III uses the Intellifont technology developed by AGFA Compugraphic and comes with eight typeface outlines: CG Times and Univers, each in medium, bold, italic, and bold italic forms. You can scale them by quarter-point increments to nearly 1,000 points. (1,000 points is more than 13 inches tall.) If you want more outlines, HP has two optional cartridges that list for \$399 apiece and contain 25 or 26 different typefaces, bringing your total to 59 scalable fonts without downloading.

Like the LaserJet IID and IIP, the LaserJet III can use older, bitmapped fonts on-disk or on-cartridge and can auto-rotate them, so that portrait fonts can be used for landscape printing. The LaserJet III goes one step further, however, and lets you reverse the direction so that you can print in four directions, all

**Hewlett-Packard
LaserJet III**

Text  7.5 ppm
speed 0 4 8 12 16 20ppm
Graphics  38 sec.
speed 0 10 20 30 40 50 sec.

Once you've torn down laws in the country and yourself face to face with the Devil, what will you have? **Courier Bold Underline** **Line Printer Bold Underline** **CG Univers Bold Underline**

FACT FILE

LaserJet III

Hewlett-Packard Co. Inquiries,
19310 Pruneridge Ave.,
Cupertino, CA 95014; (800)
752-0900.

Dimensions (HWD): 8.5 in. x
18 in. x 24.5 in.

Weight: 50 lbs.

List Price: \$2,395; scalable
font cartridges, \$399 each;
PostScript cartridge, \$695;
1MB memory expansion board,
\$495; 2MB memory expansion
board, \$990.

In Short: An outstanding value,
the LaserJet III offers scalable
fonts, vector graphics,
enhanced resolution, and
impeccable backward
compatibility with the prior
LaserJet model line—all at a
lower price than most
PostScript printers. This is the
one to beat.

CIRCLE 435 ON READER SERVICE CARD

on the same page.

While maintaining compatibility with previous PCL versions, PCL 5 now includes support for HPGL/2 commands, allowing the LaserJet III to plot vector graphics using commands that require far less data than traditional bitmapped graphics. The result is much faster printing of line art.

HPGL support provides benefits beyond speed that tread on PostScript and font-effect add-on turf. The LaserJet III can transform a scalable font character into HPGL components and then change the parameters used to print the letters. You can use this capability to slant letters at different angles or to slope the whole baseline.

In addition, PCL 5 images can be defined as transparent or opaque, allowing you to produce such fancy effects as shadowed text, pattern-filled text, or white text on top of a black or patterned background.

The LaserJet III and Series II differ in ways other than font handling. The LaserJet III comes with 1MB of memory (twice that of the Series II), and has a newly designed case and easy-to-grip paper tray. Other differences are continuations of changes that were incorporated into the IIP: raised buttons and large LED indicators on the front panel, two memory-ex-

pansion slots that can hold 1MB or 2MB boards (\$495 and \$990, respectively), and resident Courier bitmapped fonts in 10 and 12 pitch with upright, bold, and italic for each, plus a Line Printer font. The accompanying documentation is better than ever, with even more details on using the printer with many popular applications.

On the PC Labs benchmark tests, the LaserJet III clocked in at 7.5 ppm for text—the same as the Series II. In practice, you may see a performance improvement over the Series II in graphics printing. The LaserJet III supports three data compression techniques to shrink the size of graphics data, which is then automatically decompressed in the printer, thus speeding graphics printing.

So much for the differences. The LaserJet III uses the same consumables as the Series II, so the familiar toner cartridge will

work with either model. It takes the same font cartridges and soft fonts, and while dozens of major software publishers stand ready with LaserJet III drivers, the printer will work fine with a Series II driver. Like the Series II, the new unit offers face-up/face-down paper handling, and a straight-through paper path with manual feed. HP even included the expansion feature slot required by many add-on products.

Want one? Who wouldn't? But if you can't ditch your Series II, you will be able to upgrade it. HP is expected to announce an upgrade program this summer, which will let you replace the controller of your Series II with that of the LaserJet III, yielding a functional equivalent of the new printer. In the meantime, if you're in the market for a new laser printer, you won't find a better value than the LaserJet III. ■

LASERJET III FONTS: SCALABLE, WITH AUTOMATIC INSTALLATION

Edward Mendelson

FonTS designed for the LaserJet III will look better than anything else available on a 300-dot-per-inch printer and will be easier to install and use than any other fonts on the market.

The font quality produced by HP's Resolution Enhancement technology exceeds that of any other 300-dpi printer. It can't, however, match the quality you get from costly add-on controllers like the LaserMaster LX6 or DP-Tek LaserPort PS 600, which use a similar technology to produce 600 or more dpi on a LaserJet.

LaserJet III fonts are scalable typeface outlines in a format developed by AGFA Compugraphic. As with PostScript, you won't need separate bitmap files for different sizes, because the printer generates the bitmap from the outline at print time. As with PostScript fonts, some but not all LaserJet III fonts will use hints for improved quality at small sizes. Vendors who

want to use hints will license the technology from AGFA. Others, like Bitstream, claim to be able to produce fonts of comparable quality without hints.

Expect a large aftermarket in typeface outlines, some in plug-in cartridges, some in soft fonts. The LaserJet III comes with two typeface families built in: Univers, an excellent sans serif face, and CG Times, unfortunately one of the least attractive variants of Times Roman I've seen. You'll probably want a third-party substitute. The LaserJet III also accepts all bitmapped soft fonts and cartridges designed for the Series II.

Application programs will be able to install LaserJet III fonts automatically, so you won't have to wait for vendors to issue new drivers or third-party installation software. This Autofont installation technology is already built into the new WordStar, Version 6.0, and will turn up elsewhere soon. ■

First Looks

Paradox Engine

CONTINUED FROM PAGE 33

you can run an *Engine* application on one workstation while it simultaneously updates *Paradox* tables used by another.

Combined with the *Engine*, interactive *Paradox* provides a formidable application development environment for C programmers. For instance, if you need to interactively edit or modify an *Engine* database, you can use *Paradox*. You can build prototype C applications and database utilities with *Paradox*'s PAL script language before you begin writing a single line of C. Or you can use PAL to write an application's interactive front end while relegating the time-critical or hardware-specific sections to an *Engine* program (executed from inside *Paradox* via the PAL RUN command). The *Paradox* Report Generator can operate against *Engine* application tables, and you can run an *Engine* application against the results of a *Paradox* QBE query. If you want to use *Quattro Pro* to provide a spreadsheet-style front end for your C programs, go ahead—the possibilities are nearly limitless. And there are no royalties on programs developed with the *Engine*.

The *Paradox Engine* comes with libraries for both Microsoft C 5.1 and Turbo C 2.0 in the same package (Borland expects to release a version for Turbo Pascal in the near future). Since it provides only DBMS services, you're not kept from using your favorite libraries for windowing, graphics, and communications.

The *Paradox Engine* consists of over 70 functions that provide all manner of database services to a C application. You can perform global operations on *Paradox* tables and access individual records and fields. The *Engine* lets you apply password protection to a table via *Paradox*'s table-encryption and -decryption facilities. With full multiuser concurrency and record locking, you can control the extent to which other applica-



FACT FILE

Paradox Engine, Version 1.0

Borland International, 1800 Green Hills Rd., P.O. Box 660001, Scotts Valley, CA 95066-0001; (408) 438-5300. List Price: \$495 (limited introductory offer: \$195).

Requires: 512K RAM, Turbo C 2.0 or Microsoft C 5.1, DOS 3.x or later.

In Short: An industrial-strength database library for C programmers who use Microsoft C or Turbo C. Offering complete compatibility with *Paradox* 3 and Borland's other products, the *Engine* can be used to extend *Paradox* or to write custom database applications. There are no royalties on programs developed with the *Engine*.

CIRCLE 433 ON READER SERVICE CARD

tions can share tables with your programs. Further, the *Engine* lets your programs detect changes to tables it shares with other applications, so you can implement your own version of *Paradox*'s auto-refresh facility.

Paradox Engine presents a consistent application programming interface; tables and records are treated as objects that can be referred to via handles. The handles are provided by functions that open the objects. Each function returns zero if it's successful or a nonzero error value, simplifying how you write *Engine* code. All *Engine* functions begin with a "PX" prefix that identifies them as part of the *Engine* library, lessening the chance of a conflict with other libraries that you might link with your program.

While the *Engine* is a viable tool, it could stand improvement in some areas. For example, while it offers full support for *Paradox*'s indexing scheme, there is no *Engine* function that lets you sort a table (although a workaround example is provided). Nor is there support for using stored queries generated by *Paradox*'s QBE or for *Paradox*'s high-level set-based relational facilities. The *Engine* will add at least 80K to your program. And *Engine* libraries are

provided only for the large memory model. Further, Borland has not provided enough high-level features to the API (like the *dBASE* USE command), or a high-level implementation of "auto-refresh." Finally, both the current version of *Paradox* and the *Engine* suffer from a lack of EMS support.

The *Engine*'s greatest potential strength and weakness lies with Borland itself. When other companies have released proprietary technology, they've often failed to keep it up to date and move it quickly enough to new environments. Thus, it will be up to Borland to ensure that the *Engine* remains compatible with, and continues to benefit from, the features added to subsequent versions of *Paradox*. The opportunity to build applications that share data and interact with Borland's other products makes the *Paradox Engine* a worthy database development tool for C programmers. ■



BENCHMARK TEST: PARADOX ENGINE

The *Paradox Engine* uses the same core routines as *Paradox* 3.0 but takes more time on many operations because it isn't a full-fledged DBMS. For instance, the *Engine* lacks a built-in sort command, so the benchmark-test numbers reflect the time it takes to build an index on the sort order you want against the old table, read each record in sort order, and then write the records to a new table.

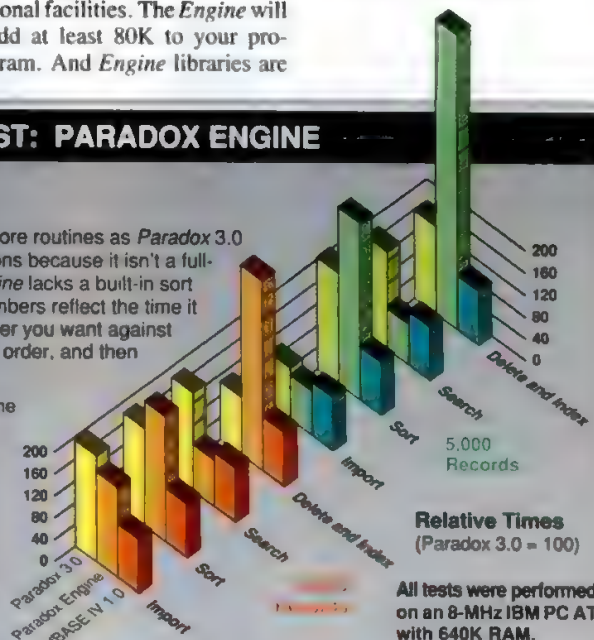
The **Import** test measures how quickly the database can import an ASCII file (of either fixed-field-length or comma-delimited format) with an index on the first field. We include the indexing portion of the test to avoid penalizing programs that automatically index the first field during the data conversion. Some programs require a two-step process for this test: an import followed by indexing.

The **Sort** test measures the time it takes for the package to sort the files on an unindexed field in ascending order.

The **Search** test measures the time it takes to locate the first record that satisfies two criteria (make = Fendhi and model = coupe).

The **Delete and Index** (four-column version) test measures the time required to remove four columns (Units, SellPrice, BuyPrice, and TranDate) from a Product table created for this task, and then to reindex the file if necessary.

Performance Times (Times given in seconds)	50,000 Records				5,000 Records			
	Import	Sort	Search	Delete and Index	Import	Sort	Search	Delete and Index
Paradox 3.0	3,176	3,254	18	659	285	188	23	60
Paradox Engine	2,720	4,183	9	2,166	246	298	10	204
dBASE IV 1.0	1,637	1,822	10	619	298	92	13	38



First Looks

VP-Planner 3D: Low-cost Alternative To 1-2-3, Release 3, Is Strong on 3-D Facilities, Worksheet Consolidation

HANDSON
by Craig Shinson

Booting *VP-Planner 3D* is like checking in at a two-star motel and getting a six-room suite with a personal valet. The newest spreadsheet from Paperback Software International (a replacement for the company's *VP-Planner Plus*) lists at \$295 and runs on humble hardware—anything with at least two floppy disk drives and 384K. But its features and performance compare favorably with those of *Lotus 1-2-3*, Release 3, a program with a much steeper price tag and hardware requirement.

Like Release 3, *VPP 3D* is a true three-dimensional spreadsheet. You can build worksheet files consisting of multiple two-dimensional pages, define ranges that span pages, create three-variable sensitivity tables, graph data along the page axis as well as in rows and columns, copy a range of rows and columns into each of many pages at once, and so on.

But, unlike Release 3, *VPP 3D* offers 3-D with a twist, allowing you to "rotate" your stack of worksheet pages. So, for example, if columns represent time, rows represent budgetary line items, and each page is devoted to a separate department, you can turn the stack 90 degrees to the left and see each department's numbers lined up side by side across the screen; each worksheet page then represents a separate time period. Or you can flip the model upward, so that time periods remain arrayed across the screen but each row is devoted to a separate department.

In addition to 3-D itself, *VPP 3D* has a few other superficial similarities with Release 3. A Perspective command lets you look at several consecutive pages at a time, for example.

/Worksheet Window commands can be used to display a graph alongside normal worksheet text. A Group mode can help you set up functionally identical pages. The program supports networking by means of a file-reservation system, prints in the background if you want it to, and recalculates in the background whether you want it to or not.

But Paperback Software has also taken pains to differentiate its product from Release 3. *VPP 3D*'s Group mode and windowing options are more flexible than those of Release 3. The program's graph commands, function repertoire, and macro language are all supersets of their *Lotus* counterparts.

The new challenger also features a handy toolkit of auditing services. These, unfortunately, will not let you trace through a chain of formula dependencies (as you can with *Microsoft Excel*'s Select Special command), but they will locate such worksheet anomalies as references to label cells or blanks in numeric formulas, formulas that appear out of place given surrounding cells, and unreferenced numeric

constants.

But the biggest difference between this program and all other conventional spreadsheets is not something that arrived with the current update. Like its predecessor, *VPP Plus*, *VPP 3D* lets you tackle very unwieldy consolidation problems by creating and manipulating multidimensional database files—what the program calls DIM files.

With a DIM file, a person overseeing financial data for a chain of stores could do such things as track accounts across time per product per store per geographical region. Such a problem would involve five dimensions (the maximum allowed in this version): accounts, time, products, stores, and regions. You could represent any three of these with the rows, columns, and pages of a 3-D spreadsheet, but handling all five would entail a multitude of separate 3-D models. *VPP 3D*'s DIM facility stores all the related data in a single set of arrays on-disk, gives you a simple way to display and update any three-dimensional "slice" of the giant pie, provides commands for generating bottom-line statistics and reports, and of course helps you set up the whole complex structure in the first place. For anyone who works with many parallel worksheets, DIMs are potentially a huge time and error saver.

They're not a lot of help for consolidating inherently non-



FACT FILE

VP-Planner 3D

Paperback Software International, 2830 Ninth St., Berkeley, CA 94710; (415) 644-2116.

List Price: \$295; upgrade from *VP-Planner Plus*, \$90.

Requires: 384K RAM, DOS 2.0 or later.

In Short: PSI's new spreadsheet offers strong three-dimensional facilities (including commands to rotate a stack of worksheet pages), weak file-linking capability, and a powerful system for updating and consolidating worksheet sets that go beyond three dimensions. An excellent low-cost alternative to 1-2-3, Release 3, particularly for those with limited hardware or unusually complex consolidation needs.

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parallel structures, however. For this kind of problem, the most practical solution is to link separate worksheets with external reference formulas. And here, *VPP 3D* is somewhat limited. The program lets you grab only one value at a time from external files, doesn't refresh the links automatically, and doesn't let you work with two or more files in memory at once.

VPP 3D looks wobbly next to the competition in two other areas as well: printed output and documentation. The program includes a miniature word processor that can generate ASCII reports complete with dynamically linked worksheet values, but it offers no fancy publishing features. For thick rules, shading, and fonts, look elsewhere.

As for the documentation, you get the two-manual set for *VPP Plus* and a third volume telling you what's new in the update. Integrating the new material with the old is your job.

These frustrations aside, *VPP 3D* is a strong product at a bargain price. It's a great value for particularly price-sensitive people who need a three-dimensional spreadsheet but can't meet the hardware requirements of 1-2-3, Release 3, or for those who have applications that can take advantage of the program's unique multidimensional database feature.

Year	Number of Shares	Price	Value	Value
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1987	100	32.42	3,242.00	1,400.00
1988	100	32.42	3,242.00	1,400.00
1989	100	32.42	3,242.00	1,400.00
1990	100	32.42	3,242.00	1,400.00
1991	100	32.42	3,242.00	1,400.00
1992	100	32.42	3,242.00	1,400.00
1993	100	32.42	3,242.00	1,400.00
1994	100	32.42	3,242.00	1,400.00
1995	100	32.42	3,242.00	1,400.00
1996	100	32.42	3,242.00	1,400.00
1997	100	32.42	3,242.00	1,400.00
1998	100	32.42	3,242.00	1,400.00
1999	100	32.42	3,242.00	1,400.00
2000	100	32.42	3,242.00	1,400.00
2001	100	32.42	3,242.00	1,400.00
2002	100	32.42	3,242.00	1,400.00
2003	100	32.42	3,242.00	1,400.00
2004	100	32.42	3,242.00	1,400.00
2005	100	32.42	3,242.00	1,400.00
2006	100	32.42	3,242.00	1,400.00
2007	100	32.42	3,242.00	1,400.00
2008	100	32.42	3,242.00	1,400.00
2009	100	32.42	3,242.00	1,400.00
2010	100	32.42	3,242.00	1,400.00
2011	100	32.42	3,242.00	1,400.00
2012	100	32.42	3,242.00	1,400.00
2013	100	32.42	3,242.00	1,400.00
2014	100	32.42	3,242.00	1,400.00
2015	100	32.42	3,242.00	1,400.00
2016	100	32.42	3,242.00	1,400.00
2017	100	32.42	3,242.00	1,400.00
2018	100	32.42	3,242.00	1,400.00
2019	100	32.42	3,242.00	1,400.00
2020	100	32.42	3,242.00	1,400.00
2021	100	32.42	3,242.00	1,400.00
2022	100	32.42	3,242.00	1,400.00
2023	100	32.42	3,242.00	1,400.00
2024	100	32.42	3,242.00	1,400.00
2025	100	32.42	3,242.00	1,400.00
2026	100	32.42	3,242.00	1,400.00
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VP-Planner 3D's /Worksheet Window Perspective command lets you see from two to six pages at a time.

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Object/1: Low-cost OOP Environment for PM Offers Rich Feature Set



Looking for an object-oriented programming environment for the OS/2 Presentation Manager that has a rich feature set but not a hefty price? *Object/1*, a \$995 program from mdbs, offers features you'd normally find in packages costing \$7,000 or more, including facilities for designing SAA-compliant interfaces; complete access to the OS/2 application programming interface (API); DDE, Clipboard, and dynamic link library (DLL) support; and a rich class library.

Object/1's interface design tools are intended for people who will not be spending their time writing code. Thus, half of an *Object/1* development team could be programmers, a tenth OS/2 PM aficionados, and the rest nonprogrammers and systems analysts who design interfaces.

Object/1 consists of several highly visual components. Its Forms Editor lets you paint an interface by selecting controls (such as buttons) from a floating palette. Dialogs are available to

associate these with methods (so that when the user presses the button, the method will automatically execute), as well as modify the control's characteristics and behavior.

Object/1 encourages SAA compliance, but doesn't enforce it. Once you complete the interface, the system creates a file of controls (with their positions, types, and sizes) and a class file with *Object/1* code for the methods. The system will protect you from overwriting existing methods and give you the opportunity to discard unused ones.

A System Browser makes it easy to modify and refine the source code: just select a method from a list box and the browser will search the source code files and let you display and edit the method's code. A Project Browser displays subsets of related classes and lets you decompose an application into small, testable pieces. And a Heritage Browser displays the hierarchy of all classes in *Object/1*, including the name of each class with its associated methods.

Other tools let you display



FACT FILE

Object/1
mdbs Inc.

Two Executive Dr., P.O. Box 248, Lafayette, IN 47902-0248; (800) 344-5832, (317) 447-1122.

List Price: \$995 (unlimited runtime license available for an additional \$995).

Requires: 4MB RAM, hard disk, EGA or VGA graphics adapter, mouse, OS/2 1.1 or later.

In Short: An excellent object-oriented development environment for the OS/2 Presentation Manager both in features and in price. With an OOP language, SAA-oriented interface design tools, a rich class library (and source code), and full support for the OS/2 API, this is the most serious PM OOP contender thus far.

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classes and method definitions and list the classes where a particular method is used. An Inspector tool lets you debug an application by interacting with the instance data of each object, and a Notifier displays message-processing errors and the history of which objects have processed which messages. You can also set breakpoints in each method.

Syntactically and expressively, the *Object/1* language most resembles C or C++. But like a pure object-oriented language, everything, even elementary C data types, is implemented as an object. Variables are typed by assignment, not static declaration, and the environment sports Smalltalk-style late binding. In addition, you can call any OS/2 API or PM GPI function from an *Object/1* program, as well as any routine in an OS/2 dynamic link library (DLL), so *Object/1* is highly extensible. This allows you to add your own features, use existing code, and explicitly take advantage of PM controls, OS/2 multithreading, and interprocess communications (even though the latter two are not part of the *Object/1* language).

But you can also access PM facilities through *Object/1*'s copious class libraries, which arrive replete with full source code for over 250 predefined

classes and 3,000 methods. The classes support all PM controls (bitmaps, cursors, icons, scroll bars, list boxes, dialogs, windows, title bars, push buttons) and C data types (bytes, integers, longs, arrays). There are also classes for adding PM Clipboard DDE interfaces to your application, as well as device handling, file handling, string handling, fonts, and database classes.

Object/1 includes a Clipboard class for moving data to and from the PM Clipboard and two DDE classes. The latter are a more intelligent and concise DDE interface than the one found in the PM API. An *Object/1* program need only create an instance of the DDE Client or Server class (depending on whether it will be requesting data from or supplying data to other applications), and the DDE object will manage the DDE conversation with other PM applications.

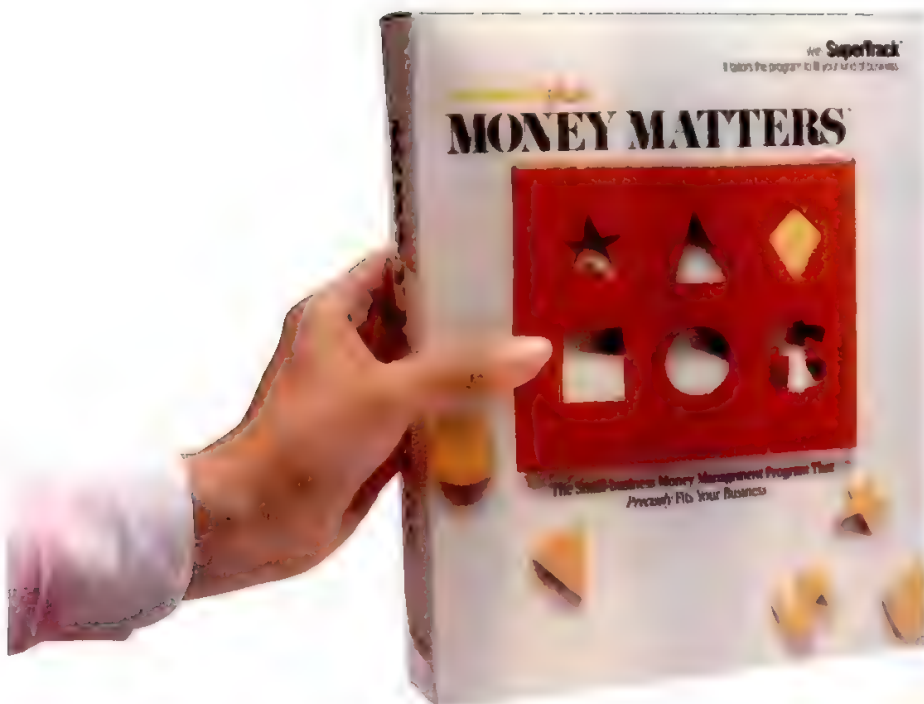
Object/1's class library also contains interfaces to *MDBSIV*, mdbs's network-model DBMS, and to its relational database, *KnowledgeMan/2*. The TBL database table manager (used in both of the mdbs databases), and a class for interfacing to it is included. What's more, *Object/1* includes an object class for accessing Microsoft's *SQL Server*. While explicit support for other databases is expected, you can access any DBMS from *Object/1* that provides an OS/2 dynamic link library and a published API.

Object/1's OOP approach has only one serious limitation: unfortunately, only single-inheritance is supported, thus you cannot derive a new class from more than one base class. And while it would be better if multithreading were an integral part of the *Object/1* language, the package's support for the OS/2 API nearly outweighs this deficiency.

Considering its price, feature set, extensibility and that it's supported by a company long established as a PC and minicomputer software vendor, *Object/1* is arguably the most serious OOP development environment for the Presentation Manager so far. ■



Object/1's Forms Painter lets you control all the attributes of an interface, including its colors.



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PC Magazine November 28, 1989



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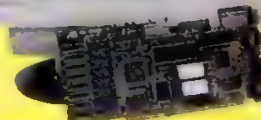
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First Looks

Impress 2.0 Challenges Allways with Better Text Support and Mouse Interface

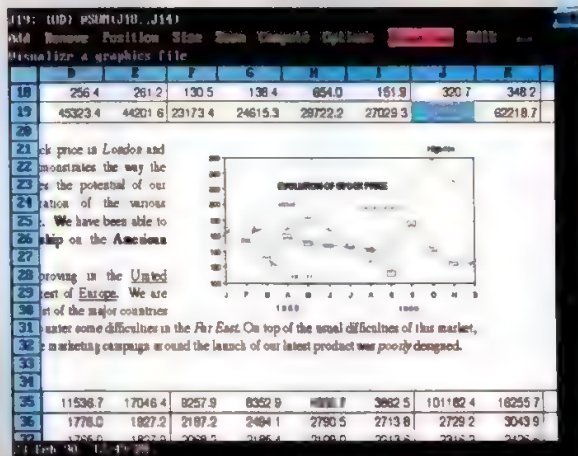
HANDS ON
by Craig Stinson

Competing with a *Lotus 1-2-3* add-in that's been bought by Lotus Development Corp. sounds like a dubious strategy. But PC Publishing's *Impress* has always offered a more complete set of publishing services than Funk Software's (now Lotus's) *Allways*. With Version 2.0, the feature gap has widened. The original *Impress* differed most significantly from *Allways* in its ability to mix "live" graphs with numeric tables. The update builds on that advantage and also adds better text support and a mouse interface.

Version 2.0 can print graphics from .PIC and .CGM files, a 1-2-3 worksheet (either the current or a named graph), and freehand drawings made with its built-in annotator, which can be used either for editing and dressing up a 1-2-3 graph or for original creations.

As for word handling, *Impress* now lets you apply a text format to a range of cells. This makes it simple to center headings over columns of numbers—a clumsy task in *Allways*. *Impress* also lets you rotate text (so you can run a title up the side of a y-axis) and assign font and style changes on a character-by-character basis. (Character-level changes are applicable only to labels and directly alter the content of the .WK1 file.)

Add to this an easy-to-use drop-shadow format and direct support for worksheets already formatted under *Allways* and you have a respectable basis for competing with the better-known product. Even without these improvements, some users might prefer working with *Impress* because it doesn't force you to toggle back and forth between a publishing mode and an editing mode. Rather, you can work in either a graphics or a



Impress lets you mix "live" graphs with numeric tables. You can dress up a 1-2-3 graph with its built-in editor.

character display and have access to both 1-2-3's and *Impress*'s menus at all times.

Unfortunately, *Impress* still suffers from an inadequate manual. The information is scanty, the organization bewildering, and the design woefully lacking—an incomprehensible shot in the foot by a company that sells a publishing product.

If you're patient and need the extra power *Impress* pro-

vides, it's a good buy. If *Allways* suffices, there's no reason to jump.

List Price: *Impress*, 2.0, \$149.95. **Requires:** 512K RAM; *Lotus 1-2-3*, Version 2.0, 2.01, or 2.2; hard disk; MCGA, Hercules, CGA, EGA, or VGA display; DOS 2.0 or later. PC Publishing, 1801 Avenue of the Stars, Los Angeles, CA 90067; (213) 556-3630.

CIRCLE 431 ON READER SERVICE CARD

PrintCache 2.2: LaserTORQ's Heir Still the Best Print Spooler

HANDS ON
by Henry Fersko-Weiss

The worst part of printing, even with a laser, is the wait. *PrintCache* 2.2, LaserTools Corp.'s \$149 print spooler, does more to reduce the wait than any other software on the market.

Virtually all software can send data to a printer faster than the printer can print it, and the bottleneck at the printer causes delays in the computer. A software print spooler sits in RAM,

scoops up data as fast as the application sends it, and then stores the data until the printer is ready to receive it. Meanwhile, your application is free to get on with other work, and you're free to exit the application and start something else.

PrintCache is the fastest software print spooler, partly because it doesn't waste RAM on features like queue control, which you probably don't need, and partly because it's the only spooler that uses interrupts to

learn when your parallel port is ready to receive more data.

PrintCache is the descendant of two earlier software spoolers: *LaserTORQ*, which included special features for laser printers, and *TORQ*, which didn't. The new combined version is faster, smaller, and more flexible than its ancestors, and it even lets you install spoolers for more than one printer attached to the same computer.

If you want to use its pop-up menu, which lets you eject a page or clear the buffer, the *PrintCache* TSR needs 19K of DOS RAM. If you don't need the pop-up menu, it needs only 6K. While *PrintCache*'s TSR is tiny, its storage area for data can be virtually any size and stowed in conventional, expanded, or extended RAM or on-disk for large DTP jobs.

The speed improvements you get from *PrintCache* depend on your software and the work you do. The best results come with applications that print only in the foreground. When we printed a complex one-page *Ventura* file to a LaserJet without *PrintCache*, we waited 71 seconds before returning to the editing screen. With *PrintCache* installed, we waited 9 seconds.

With programs that have their own built-in spoolers, like *WordPerfect* or *Windows*, the main advantage of *PrintCache* is that you can exit faster. For example, without *PrintCache*, *WordPerfect* kept us from exiting for 90 seconds while printing a ten-page file with soft fonts. With *PrintCache*, we could exit after 5 seconds.

PrintCache has built-in graphics data compression that can often—but not always—let you print full-page graphics on a LaserJet with only 512K of RAM. Even if you don't need data compression, you'll want the program for its skill at compressing the time you spend waiting for your printer.

List Price: *PrintCache*, \$149; upgrade, \$25. **Requires:** 5.5K RAM, 19K RAM for pop-up, DOS 2.1 or later. LaserTools Corp., 5900 Hollis St., Emeryville, CA 94608; (415) 420-8777.

CIRCLE 437 ON READER SERVICE CARD

First Looks

View-It: \$69.95 File Browser Is Strong on Video Control

HANDS ON
by Neil Rubenking

Among the assortment of utilitarian text browsers, V Communications' *View-It* is a dazzling light. Produced by the creators of the popular *Sourcer* disassembler, *View-It* distinguishes itself with superb video control, a flexible user interface, and customized display options for different file extensions.

View-It can function on CGA or monochrome systems, but it uses arcane features of EGA and VGA adapters to create a unique display. By defining characters beyond the usual 256 ASCII characters, it gives the appearance of an unusually high-resolution graphics display. *View-It* will also put more than 80 columns and more than 25 rows of text on the screen, zooming up to a theoretical maximum of 160 columns and 100 rows. You can store the three best-looking zoom settings and make them available at the touch of a key. Some zoom settings may turn out to be beyond the capabilities of your system—pressing the Esc key brings back standard 80 by 25 mode.

View-It keeps a list of file extensions, with distinct display options for each. For example, an .ASM file normally stays within 80 columns, but the corresponding .LST file is wider. .COM and .EXE files default to a hexadecimal display. And the program's remarkable MSearch (multiple search) ability lets you have up to eight keywords highlighted wherever they appear in a given type of file.

The slick *View-It* interface takes input from the mouse or keyboard, and the screen is always informative. When you press the Shift key, the on-screen function-key listing changes. Markers on the top row display the context-dependent functions of the mouse buttons. If you'd rather use a famil-

iar interface, *View-It* offers keyboard layouts compatible with seven popular editors and an option to define your own layout.

View-It will display two files

at once, split either horizontally or vertically. You control the size of each, and you can lock them so that the two windows scroll together. Want to print the screen? *View-It* adds user-specified setup strings and form feeds, suppresses the top and bottom status lines, and prints lines that extend beyond the sides of the screen.

At \$69.95, *View-It* bears a higher list price than most file browsers, but you can expect to

buy it on the street for under \$50. Its innovative display and interface make it a distinct pleasure to use. ■

List Price: *View-It*, \$69.95.

Requires: 384K RAM; MDA, CGA, EGA, VGA, SVGA, or Hercules graphics adapter (EGA or above required for zoomed text modes). V Communications Inc., 4320 Stevens Creek Blvd., #275, San Jose, CA 95129; (408) 296-4224.

CIRCLE 432 ON READER SERVICE CARD

ColorSep/PC Takes First Step Toward PC-based Professional Color Publishing

HANDS ON
by David Coombe

Desktop publishing aficionados who want to use their PCs as a front end for professional-quality color publishing will welcome Ozette Technologies' *ColorSep/PC*. This \$495 graphics utility takes color PostScript code and converts it into four files that correspond to the Cyan, Magenta, Yellow, and Black film negatives needed to generate printing plates.

On start-up, *ColorSep/PC* presents you with an old-fashioned data-entry screen where you specify output parameters like line screen, screen angle, trim size, and dot gain. For those who find this terminology confusing, *ColorSep/PC* includes on-line help that functions mostly as a dictionary of production lingo. The program also offers commonsense solutions to difficult problems such as the ability to automatically compensate for dot gain based on densitometer readings.

It takes just a few minutes to learn the function keys that control *ColorSep/PC*'s main operations. F2, for example, loads a PostScript file, and F10 begins the separation process.

ColorSep/PC assumes that you will prepare files for output on high-resolution typesetting devices like the Linotronic 300 at a service bureau. So, in addition to labeling each piece of film with crop mark, color, and client information, the program generates a report that lists the output specifications and item-

izes the .EPS files and soft fonts used in a document.

ColorSep/PC not only works as advertised, but it's honest about its limitations. Separating a 72K *PageMaker* file that contained both .WMF and .EPS

Of course, *ColorSep/PC* had some problems. For example, two attempts at using the automatic installation program yielded WIN.INI files that didn't work. (The program wisely creates a backup copy



As shown by this detail of a color key, *ColorSep/PC* separates the PostScript code used to create Cyan, Yellow, Magenta, and Black plates.

color graphics took only about a minute. Proofing the separations was as simple as downloading each file (Cyan, Magenta, Yellow, and Black) to a PostScript-compatible laser printer using the DOS Copy command. However, unlike Aldus's soon-to-be-released Mac-only program, *PrePrint*, which can separate full-color photographic bit-mapped images, *ColorSep/PC* will interpret only flat-tint information contained in vector format.

Three versions of *ColorSep/PC* cover the spectrum of high-end PC desktop publishing. *Windows* users benefit from such conveniences as *ColorSep/PC*'s ability to create a virtual port: connect your printer to this port and your files will print to disk automatically.

called WIN.CSP.) And the on-line help is vastly superior to the illogically structured manual.

Though limited to vector color files, *ColorSep/PC* significantly advances the capabilities of PC-based color DTP. At the moment it is the only PC-based link between the color PostScript files on your hard disk and four-color film required by commercial printers. ■

List Price: *ColorSep/PC*, *PageMaker/Windows* version: \$495; *GEM/Ventura Publisher* version: \$495; *Service Bureau* version: \$795. **Requires:** 640K RAM, DOS 2.0 or later. Hard disk recommended. Ozette Technologies, a division of L&K Communications Inc., P.O. Box 208, Morrisville, PA 19067; (215) 493-2720, (215) 493-2730.

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First Looks

Quarterdeck's QRAM Solves Memory Squeeze for 8088, 8086, and 80286 Machines

HANDS ON
by Alfred Poor

Like *QEMM-386*, Quarterdeck Office Systems' *QRAM* is a memory manager that lets you perform tricks like loading device drivers and TSRs into memory above 640K. Unlike *QEMM-386*, the new \$79.95 utility offers its services to older 8088, 8086, and 80286 machines instead of working solely with 80386-based PCs. (For a review of *QEMM-386*, see First Looks, March 27, 1990.)

If your PC or AT has only 640K of RAM, the best *QRAM* can do for you is extend conventional memory by a maximum of 96K—if you have an EGA or VGA graphics card and run applications that do not use graphics. In this case, *QRAM* recovers some of the graphics video buffer area for other uses. To realize a potentially bigger gain, your system must have LIM EMS 4.0- or EEMS-compatible hardware or must have Chips and Technologies shadow RAM. (Some LIM EMS 3.2-compatible cards will work with a LIM EMS 4.0 driver, but will not work with *QRAM*.) Depending on your hardware, you'll see a memory gain of 30K to 130K.

Configuring memory is often viewed as a black art, but *QRAM* goes a long way toward demystifying the process. An installation program puts the program files on your disk and modifies your boot files so that the *QRAM* driver is loaded and your path includes the *QRAM* directory. Next, you can run *Optimize*, a program that inspects your *CONFIG.SYS* and *AUTOEXEC.BAT* files for device drivers, TSRs, and DOS resources that can be put into high memory (640K to 1,024K). When the dust settles and the C:> prompt returns, you'll wind up with new boot

files (the old ones are renamed and safely stored away in case you need them) and a fully re-configured system. If you want to fine-tune your settings, the documentation does an excellent job of explaining your options.

As an initial promotion, Quarterdeck is bundling its \$59.95 system-analysis and reporting utility, *Manifest*, with *QRAM*. *Manifest* gives you a profile of your memory map,

BIOS, drivers, and more, all through a simple menu-driven format. It assists you in diagnosing memory conflicts and offers optimization hints.

In the process of returning valuable memory to your system, *QRAM* makes a complex job simple. Its intelligent installation and configuration programs should serve as models for future packages, since they make a task that requires technical proficiency as easy as pressing the Spacebar. ■

List Price: *QRAM*, Version 1.0, \$79.95. **Requires:** LIM 4.0- or EEMS-compatible hardware or Chips and Technologies shadow RAM, DOS 2.0 or later. Quarterdeck Office Systems, 150 Pico Blvd., Santa Monica, CA 90405; (213) 392-9851.

CIRCLE 461 ON READER SERVICE CARD

DoDOT Tackles Screen Captures, File Conversions Under Windows

HANDS ON
by Robin Raskin

Microsoft Windows users who need to capture full screens, single windows, and even areas within a window and then to save them in any number of file formats will have reason to take note of *DoDOT*. Halcyon Software's \$129 utility eliminates the troublesome keyboard conflicts and RAM shortages that plague TSR screen-capture programs, but isn't without prob-

lems of its own.

A well-behaved Windows program with pull-down menus and dialog boxes, *DoDOT* can save screen captures in 16 different formats, including the popular TIFF, .EPS, .GIF, and .PCX formats as well as the more esoteric .SCR, .PCL, *Dr. Halo*, and MAC formats, among others. Recalled images can easily be converted to other formats.

DoDOT has a lot going for it. The program captures

screens and accurately converts them to color PostScript format—something no other screen-capture program does very well. Because *DoDOT* uses disk space, not memory, to store converted images, your files are virtually unlimited in size.

DoDOT offers you a fair degree of control over conversions. Both Intel and Motorola TIFF formats are selectable—an aid for users of both Macs and PCs. Both LHZ and PackBits TIFF compressions are supported, although the standard CCITT TIFF format for faxes is not. A dithering algorithm converts any color screen to black and white. You can view captured images on-screen and print them on any Windows-supported printer. The print option lets you interactively size an image prior to printing.

Like other screen-capture programs, *DoDOT* does the job right about 90 percent of the time and seems to work best with files that conform to the TIFF 5.0 specification. But it also has its share of loose ends—mysterious blank dialog boxes, half-true error messages, and an undocumented process for reassigning temporary file storage locations. Like most capture software, it will convert files to but not from the .EPS format. Unlike other programs, it misleadingly offers you that choice on a menu.

DoDOT lacks the editing features found in other capture programs. If you need to annotate screens, create borders, or perform any pixel-based editing tasks, other programs are better suited.

Halcyon Software is readying versions of the program for Windows 3.0 and the OS/2 Presentation Manager. The vendor offers free technical support, and its BBS provides technical tips as well as a collection of downloadable .GIF images. ■

List Price: *DoDOT*, \$129. **Requires:** Microsoft Windows/286 or /386, Versions 2.x or later; mouse; DOS 3.0. Halcyon Software, 10297 Cold Harbor Ave., Cupertino, CA 95014; (408) 257-0812.

CIRCLE 468 ON READER SERVICE CARD



DoDOT can save screen captures in 16 different formats, among them .TIF, .EPS, and .PCX.



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CIRCLE 471 ON READER SERVICE CARD

First Looks

Two Diagnostic Utilities Help Ferret Out Hardware Problems and Conflicts

HANDS ON
by Lori Grunin

Anyone responsible for one or more PCs knows that they're not just machines; they're the battlegrounds on which boards practice guerrilla warfare and programs face off in byte-to-byte combat.

With all that activity going on under the hood, we need all the help we can get; what we get are *CheckIt* (\$149) from Touchstone Software Corp., and *QAPlus* (\$134.95) from DiagSoft. These two utilities provide useful information about a system's hardware configuration and memory usage, as well as diagnostic test suites and rudimentary performance benchmarks. You can print reports of system information and test results.

Both identify basic system components such as CPU, NPU (Intel only), and video type; as well as the amount of base, extended, and expanded memory; drive configurations; and port addresses. They also check for the presence of mice and game cards. *QAPlus* recognizes 80486 chips and comes on a bootable floppy for use with

non-DOS systems; *CheckIt* goes only as high as the 80386.

In addition, the programs list standard DOS-device IRQ and DMA channel assignments—those used by ports and mice—and software interrupts. *CheckIt* ventures slightly beyond *QAPlus* by attempting to ferret out the information from loaded device drivers. For instance, *CheckIt* successfully recognized a network board, but since it doesn't yet understand removable-media device drivers (such as tape and CD-ROM drives), it missed a Bernoulli Box.

Both utilities itemize device drivers, including their segments and offsets, attributes, and characteristics. In addition, for standard DOS devices, *CheckIt* includes the minimum DOS version required to support the device.

QAPlus also has a CMOS editor, which resembles the BIOS diagnostic/setup program included with many recent BIOSs; it lets you update the CMOS clock, change memory sizes, specify the error conditions under which a system will halt, and define the drives and

video types. *CheckIt* allows you to view but not edit CMOS information.

The relatively extensive testing of the system, memory, and peripherals is one of the great strengths of the two utilities. Both test the I/O ports, system board, memory chips, printer,

so. It simply won't run the tests if you have an EMM device driver loaded, and (of course) doesn't see any expanded memory if you *don't* have the device driver loaded. *QAPlus* also defaults to a batch mode for running all tests, in which you deselect the tests you don't want to run; *CheckIt* offers both individual tests and a well-designed batch menu.

Although the inability to identify the IRQ's and DMA channels used by most boards is primarily the fault of ISA-bus architecture, it somewhat limits the usefulness of hardware diag-



This cropped screen shows *CheckIt*'s RAM layout display. You must first tell the program your RAM setup.

display, mouse, and joystick. In addition *QAPlus* includes a very nice on-screen breakout box for COM port debugging; it can accept scripts for a batch workout.

If a bit fails the memory test, these programs help you pinpoint the location of the bad chip. In order to identify the source of a memory error, you must first designate the chip size and layout of the banks (for example, parity chip on left or right). It isn't necessary to input this information in order to run the memory tests, only to locate the source of an error.

The testing and RAM layout sections tend to be the most confusing and flawed parts of the programs. In *CheckIt*'s memory layout module, you tell the program how many *banks* of chips you have; most people tend to think in terms of rows or columns of chips. Neither package takes into account SIMMs, so you have to perform some mental gymnastics to imagine your SIMMs as DIPs.

Neither program currently tests expanded memory, but *QAPlus*'s manual doesn't say

hostic utilities. In many cases you still have to resort to card swapping to thrash out hardware conflicts. Furthermore, for in-depth memory information, neither one of these programs comes close to Quarterdeck Office Systems' *Manifest*.

On the other hand, much of the information *CheckIt* and *QAPlus* provide can really help, especially if you're giving remote technical support to a user running the program on his machine. For end users, both DiagSoft's and Touchstone's technical support are good at helping to understand any errors reported while running the tests. ■

List Price: *CheckIt*, Version 2.1, \$149. **Requires:** 384K RAM, DOS 2.0 or later. Touchstone Software Corp., 909 Electric Ave., Seal Beach, CA 90704; (800) 531-0450, (213) 598-7746.

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List Price: *QAPlus*, Version 4.21, \$134.95. **Requires:** 384K RAM, DOS 2.0 or later. DiagSoft Inc., 5615 Scotts Valley Dr., #140, Scotts Valley, CA 95066; (408) 438-8247.

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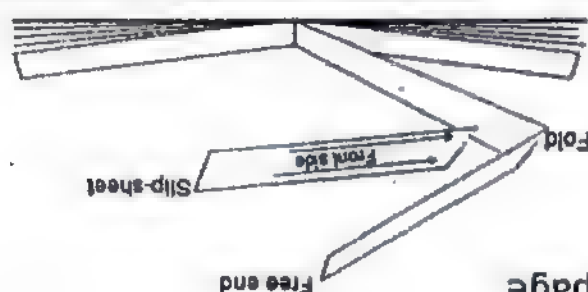
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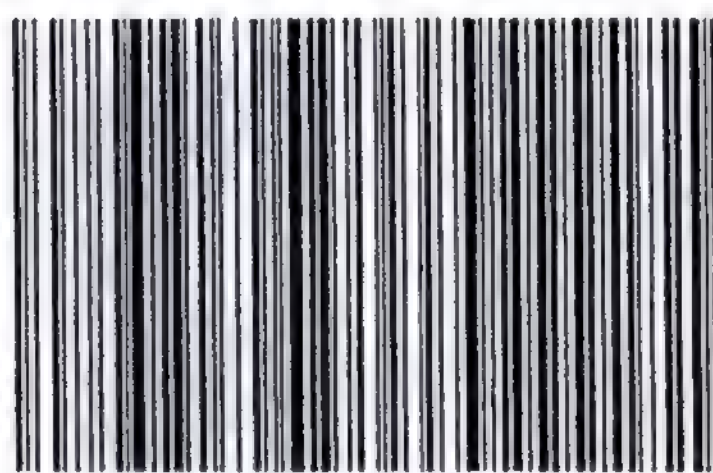
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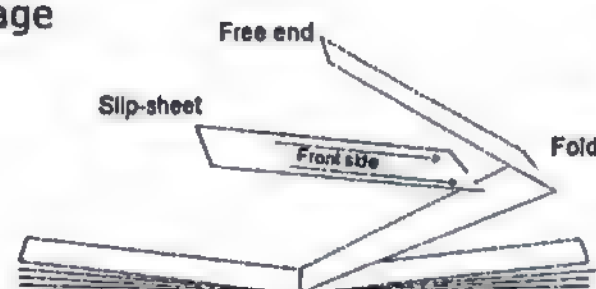


GbsSlipSheet-001

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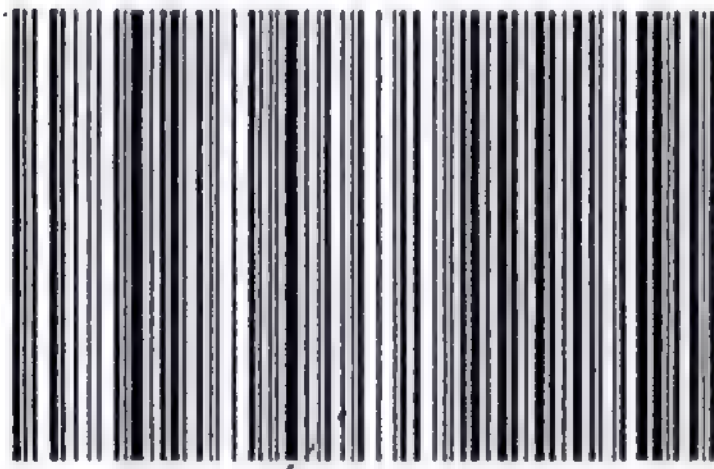
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1. Follow instructions on the other side

Inverted Back



Gbs5lpBack-001B

Back

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10 Good Reasons To Buy From ZEOS®

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Reason #2

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In one recent '386 review, *PC Magazine* awarded ZEOS Editors Choice. "The ZEOS '386 blows away every other computer... a smart choice" is what they said. And in another recent review, *Government Computer News* said the ZEOS 33MHz '386 is "arguably the fastest MS-DOS and OS/2 micro in the world."

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Reason #3

Exceptional Quality.

PC Resource Magazine put it this way, "ZEOS... provides quality comparable with IBM or Compaq and does so for about 70% of the price." ZEOS uses only the very best components. And every system is fully tested and burned-in right in our own labs.

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First Looks

FontSpace Squeezes LaserJet Fonts, Then Expands Them on the Fly

HANDS ON
by Edward Marston

If you're feeling cramped by all those soft font files that are rapidly taking over your hard disk, *FontSpace* can give back some elbow room. Isogon Corp.'s \$89.95 utility compresses LaserJet soft fonts to an average of one-fourth their original size. It lurks as a TSR (terminate-and-stay-resident) program in as little as 3K of DOS RAM to expand the fonts to their original size when you download them to the printer. The whole procedure is fast, transparent, and foolproof.

When you install *FontSpace*, you tell it to compress the font files on your disk. You can tell it to look for fonts in all your disks and directories or only specified directories. The program is smart enough to compress only files that conform to the LaserJet font format and to recognize font files no matter what they're called. Any new fonts that you create while the memory-resident portion of the program is loaded into memory will be compressed as they are written to disk.

When *FontSpace* compresses LaserJet fonts they shrink anywhere from about 50 to 95 percent of their original bulk. Typical space savings reach 70 percent or more. The program squashed the 2.2MB of LaserJet fonts that come with *Ventura Publisher* down to 660K. The TSR portion of the program is equally compact. With expanded memory that conforms to Version 3.2 or later of the LIM specification, it takes only 3K of DOS RAM and about 45K of expanded memory. If you don't have EMS, it normally takes 26K of RAM.

To save time as well as space, you can use *FontSpace* with *BackLoader*, a font-down-

loading program. The two work together transparently: when *BackLoader* downloads a compressed font, *FontSpace* automatically expands it.

FontSpace exacts an impressively small time penalty when expanding soft fonts in RAM.

On a 386 machine, a complex multifont file that normally takes 82 seconds for downloading and printing needed only 6 more seconds with *FontSpace*. Because *FontSpace* uses special functions of the 80386 for extra speed, older CPUs will produce slightly less impressive results.

FontSpace is a limited counterpart of utilities like Isogon's *NewSpace* that work on-the-fly to compress and expand all the data on your disk. All-purpose file compressors make disaster recovery difficult, but *FontSpace* safely limits itself to compressing font files that are easily regenerated or restored.

And it safely weathers disk errors and other tight spots that can cause data loss with on-the-fly compression programs from other vendors.

Nothing makes you feel the need for a new hard disk more urgently than a set of LaserJet fonts. *FontSpace* is an effective \$89.95 alternative to a thousand-dollar disk. ■

List Price: *FontSpace*, \$89.95.

Requires: 25K RAM (3K with EMS 3.2 or later), hard disk, DOS 3.0 or later. Isogon Corp., 330 Seventh Ave., New York, NY 10001; (800) 662-6036, (212) 967-2424

CIRCLE 446 ON READER SERVICE CARD

Treeview: Macro Commands, Split Screens Distinguish Shareware File Organizer

HANDS ON
by Barry Simon

A program has to do a lot in order to distinguish itself from the crowded field of DOS shells and file organizers. *Treeview*, a flexible and powerful shareware program from Magee Enterprises, has all the features you'd expect to see in any shell or file organizer, plus some that set it apart from the pack.

Among the features that typify this class of product are *Treeview*'s ability to mark files and then copy, erase, or move

them. The program has an ASCII file viewer with bookmarks, a search capability, and a hexadecimal mode. And the program lets you view a tree diagram of a disk's directories or all the files on a disk.

Several features go beyond the standard fare. You can split a screen horizontally into as many as six windows and then view files from different directories—even all of the files on several different drives—in each one. You'll need sufficient memory to display several entire hard disk partitions. But

since the program supports EMS, you may not find this to be a problem.

In practice, you probably won't want to clutter your screen with six windows in the 43-line (EGA) or 50-line (VGA) modes that the program supports, but you'll find that three windows make for comfortable viewing. Also easy on the eyes is *Treeview*'s user interface, which supports a mouse and drop-down menus.

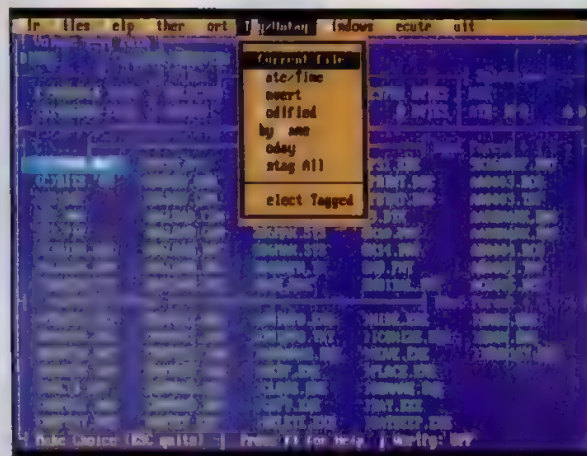
Treeview's handling of the archive bit is especially strong. With a few keystrokes, it will show all files on the disk that haven't been backed up.

But *Treeview*'s macro commands are what most distinguish the program from the leading file organizers. You can define a set of up to 30 commands that are issued with function keys. Macros act on either the current file or all marked files. Furthermore, once you create a point-and-shoot table, choosing the Xecute command from the main menu and hitting Enter will launch a program—a feature that's standard with big guns like *XTreePro Gold* and *Lotus Magellan*. ■

List Price: *Treeview* 1.1, \$50 (shareware); available for a trial period from PC MagNet's UTILFORUM LIBRARY 8.

Requires: 256K RAM, hard disk, DOS 2.0 or later. Magee Enterprises Inc., P.O. Box 1587, Norcross, GA 30091; (404) 446-6611, (800) 662-4330 (orders only).

CIRCLE 448 ON READER SERVICE CARD



TreeView lets you split the screen horizontally into as many as six windows.

The Product Is Great, The Price



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LAN TIMES
**READERS
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by
Matthew J. Ross

New & Improved

News of Announced Products and Upgrades

Mapix Desktop Mapping Program for Windows Uses .PCX Format

NEW

Hyperdyne's *Mapix* is a Geographic Information System (GIS) that operates under Microsoft Windows and uses raster scan (bit-mapped) representations of maps stored as .PCX files. This makes *Mapix* compatible with any paint program, printer, or scanner that uses the .PCX file format.

Mapix supplements an image file with a corresponding Map Dataset file that allows *Mapix* to geocode the map image; it relates given points on the image to corresponding coordinates on the Earth's surface, such as latitude/longitude or municipal state plane coordinates. Since the Map Dataset files are stored as comma-delimited text files, users can create their own maps. *Mapix*'s computer-assisted geocoding function lets you scan in any map, assign the proper coordinates, and then store your map to disk.

The size of the maps displayed, which can be either monochrome or have up to 256 col-

ors, is limited by your hard disk. User-controlled data overlays allow you to fix icon Symbols at specific geographic points, create Routes, or specify a given area as a Zone. These overlays can be saved or edited, and they maintain their position as you pan or zoom across the map. With the included icon editor, users have the freedom to add or edit



Mapix uses its geocoding functions and .PCX files to create color maps like this one of Zurich, Switzerland.

icons. Map displays can be printed or expanded to other software applications. Hyperdyne intends to offer all government survey maps in optional libraries.

List Price: *Mapix*, \$1,795. Hyperdyne Inc., 4004 Woodland Rd., Annandale, VA 22003; (703) 354-7054.

CIRCLE 442 ON READER SERVICE CARD

HOT PROSPECT

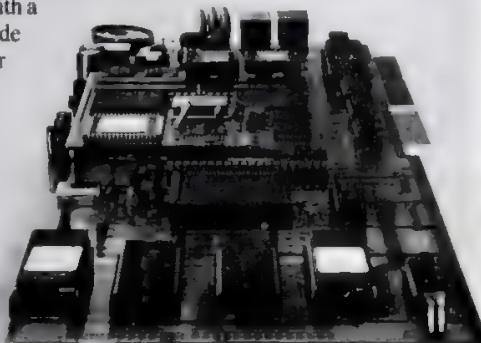
HIGH-SPEED INTERNAL MODEM COMBINES DATA COMPRESSION WITH INDUSTRY STANDARDS

Forval America unveils the Forval IM14400, one of the first IBM-compatible internal modems to conform with V.32bis, V.42, and V.42bis standards and to include MNP Level 5 data compression.

The IM14400 offers up to a 14.4-kilobit-per-second transfer rate for uncompressed data and is compatible with the Hayes AT command set. Capable of both synchronous and asynchronous communications, the Forval IM14400 can transfer data up to 57.6 kbps when communicating with another IM14400. The IM14400 can automatically negotiate a fall-back speed when talking with a slower modem. Fall-back speeds include 9,600, 4,800, 2,400, and 1,200 bits per second.

In place of EPROM chips, the IM14400 ships with *Forval-Link*, downloadable software that controls features such as transmission speed and security algorithms. This allows product customization and upgrades to be performed remotely from Forval headquarters.

List Price: Forval IM14400, \$1,045. Forval America Inc., 6985 Union Park Center, #425, Midvale, UT 84047; (801) 561-8080.



The Forval IM14400 internal modem conforms to advanced transmission standards.

CIRCLE 439 ON READER SERVICE CARD

AboveX Facilitates Remote File Transfers Under DOS, OS/2

NEW

AboveX, from *Above Software*, incorporates time features that enable you to send compressed messages at the most cost-effective time, works either in the foreground or unattended, and offers three encryption methods as well as ten user-definable security levels in an easy point-and-click interface.

Directory-tree file selection allows you to select multiple files from different directories and view the file contents. An icon-based storage system uses in- and out-baskets for easy operation. An autosensing installation works with modems with transmission rates from 300 to 19,200 bits per second and recognizes COM3 and COM4 ports, as well as OS/2 COM device drivers.

List Price: *AboveX*, \$495. **Requires:** 512K RAM, 300 to 19,200-bps Hayes-compatible modem, DOS 3.0 or later or OS/2 1.0 or later. *Above Software Inc.*, 3 Hutton Center, #950, Santa Ana, CA 92707, (714) 545-1181.

CIRCLE 441 ON READER SERVICE CARD

New & Improved

Business Wits Helps Executives Make Decisions

NEW

The art of decision making is the key to success for any manager or business executive. To help make this process easier, *Business Wits*, a new interactive environment from **Decisus** aids in problem solving, data analysis, and decision support. *Business Wits* incorporates 118 business techniques used in everyday decision making in a dynamic object-oriented system that allows you to assemble a particular program with the necessary formulas, variables, and functions.

Featuring programs taught in major universities and used in business, finance, and industry today, *Business Wits* solves problems and helps you develop strategies for forecasting, pricing, finance, inventory, sta-

tistics, quality control, and investment.

You can customize preprogrammed models or create new ones to solve complex problems, and built-in trainers guide you step-by-step. Three additional application libraries are available: advanced finance; statistics and sampling; and investments, banking, and commerce.

List Price: *Business Wits General Business Library*, \$595, \$695 after June 30, 1990; Additional libraries retail for \$150. **Decisus Inc.**, 9938 Via Pasar, Suite A, San Diego, CA 92126; (619) 530-4800.

CIRCLE 440 ON READER SERVICE CARD

NEC Expands ProSpeed Portable Line With New SX

NEW

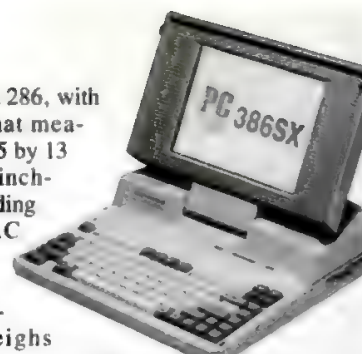
NEC Technologies has added a new 80386SX-based computer to its line of battery-powered ProSpeed portables. The ProSpeed 386SX features a similar design to the

ProSpeed 286, with a case that measures 3.25 by 13 by 14.9 inches. Including the AC power block, the system weighs 15.64 pounds; the battery option weighs slightly more.

The ProSpeed 386SX features 640-by-480 VGA resolution in its high-contrast liquid crystal display. NEC offers a 40MB or a 100MB hard disk, and system memory is expandable to 9MB. Expansion possibilities include NEC's laptop expansion (LTX) slot, a dedicated modem slot, and NEC's Expansion Station that accepts one 8-bit and three 16-bit full-length ISA cards.

List Price: NEC ProSpeed 386SX, with 1MB RAM, 40MB hard disk, 3.5-inch 1.44MB floppy disk drive, VGA liquid crystal display, DOS 4.01, \$5,999; with 100MB hard disk, \$6,799. Battery pack, \$199; expansion station, \$999. **NEC Technologies Inc.**, 1255 Michael Dr., Wood Dale, IL 60191; (708) 860-9500.

CIRCLE 444 ON READER SERVICE CARD



IMPROVED

OverDrive2 for Microsoft Word

The latest release of *OverDrive Systems'* add-on for *Microsoft Word* adds new merging features: MergeLink, Query by Form, and Data Diary. With MergeLink, *Microsoft Word* users can import ASCII, *Microsoft Excel*, *dBASE*, *Paradox*, and *Lotus 1-2-3* data directly into documents.

MergeLink facilitates entering addresses directly into form letters, mailing labels, and mail-merge forms. A split window makes merging between document and data file easy in *OverDrive2's* point-and-click environment. Query by Form allows users to quickly find the right records within a data file. You can then select the desired range of records from a number of file formats to incorporate into a single document or multiple forms.

Data Diary automatically stores customer information in data files. When used in conjunction with *OverDrive2's* powerful Library Manager, which organizes up to 125,000 *Word* documents, users can manipulate data retrieval of frequently used information, forms, and documents. *OverDrive2 for Microsoft Word* retails for \$149, and requires *Microsoft Word*, Version 5.0. **OverDrive Systems Inc.**, Cleveland, Ohio; (216) 292-3425.

GoScript, Version 3.0—The latest upgrade of **LaserGo's** PostScript language interpreter adds several features, including a new menu-driven interface and the ability to export files in .PCX or TIFF formats.



OverDrive2 for Microsoft Word makes merging documents from various file formats as easy as choosing from a menu.

GoScript offers either a 13-font edition at a reduced price of \$149 (down from \$195) or an extended 35-font edition.

GoScript supports **LaserGo's** *GoFonts* library of over 2,000 typefaces. The new *GoPrint* utility allows users to print text files in any size or typeface from the *GoFonts* library. Two new features in Release 3.0 are the ability to preview PostScript language print files on your EGA or VGA color monitor and additional printer support. Printer drivers are included for the **IBM LaserPrinter**, **Okidata ML 321**, **Tall Tree J Laser 5 Card**, and the **Xerox 4045 laser printer**. The 35-font edition of *GoScript*, Version 3.0, retails for \$299 and the 13-font edition sells for

\$149. **LaserGo Inc.**, San Diego, Calif.; (619) 450-4600.

Microsoft Word 5.0 Supplemental Dictionary Kit—**Microsoft Corp.** has made supplemental word lists available for *Microsoft Word*, Version 5.0. These additional dictionaries allow users to check the spellings of foreign words or special terms without exiting *Word*.

Furthermore, **Microsoft** has also released a supplemental dictionary for the medical and legal professions, allowing users to check the spelling of terms specific to these fields. The foreign-language supplemental dictionary functions identically to the dictionary that ships with *Microsoft Word* 5.0 or 4.0, and the medical and legal dictionary is

CONTINUES ON PAGE 56

Will the real 1-2-3 "upgrade" please stand up.

This may come as a shock. But the real "upgrade" to 1-2-3* isn't from Lotus.* It's QUATTRO PRO from Borland.

\$99⁹⁵

Seeing is believing. That's why we're making a very special offer to owners of 1-2-3, Supercalc,* Symphony,* or PC Excel*... For a limited time, you can step up to QUATTRO

PRO—a \$495 value—for only \$99⁹⁵, with absolutely NO RISK. If, within 60 days, you're not completely satisfied—return QUATTRO PRO for a no-questions-asked refund.

Lotus' "choice" of upgrade products is really a compromise! 1-2-3 release 2.2 has advanced publishing. Release 3.0 offers multi-page consolidation. Neither has both. QUATTRO PRO lets you do *both* multi-page and free-form consolidation—*AND* advanced publishing.



without translation. And VROOMM enables QUATTRO PRO to run on PCs ranging from an XT-class machine to an 80486.

Consolidation puts it all together

QUATTRO PRO's *Hot Link*™ capability lets you combine up to 64 spreadsheets (even ones not loaded in memory) into a single consolidated spreadsheet, complete with "live" graphs, then display them in up to 32 tiled or overlapping windows. And

QUATTRO PRO can query external database files including Paradox* and dBASE.*

Reports and graphs that dazzle and persuade

QUATTRO PRO creates boardroom-quality reports and presentations easily. Advanced publishing capabilities such as drawing tools, clip art, Bitstream* fonts, and electronic slide show rival those of stand-alone graphics packages.

Upgrade to the experts' choice now!

The computer industry's top software evaluators have unanimously picked QUATTRO PRO. So Lotus 1-2-3 owners, isn't it worth \$99⁹⁵ to find out why?

REPORT CARD							
High-End PC Spreadsheets							
	QUATTRO PRO Version 1.0	Lotus 1-2-3 Release 2.2	Lotus 1-2-3 Release 3.0	Plan Perfect Version 3.0	Excel/Windows Version 2.1	Supercalc 3 Version 3.0	InfoWorld
Price	\$99	\$95	\$95	\$95	\$95	\$95	
Performance							
Formulas analysis (100)	Good	Good	Good	Good	Excellent	Good	
Compatibility (80)	Excellent	Excellent	Excellent	Good	Very Good	Very Good	
Speed (70)	Very Good	Very Good	Very Good	Satisfactory	Very Good	Satisfactory	
Databases (70)	Excellent	Satisfactory	Very Good	Very Good	Very Good	Very Good	
Graphics (70)	Excellent	Poor	Good	Good	Good	Very Good	
Output (80)	Very Good	Very Good	Satisfactory	Good	Excellent	Good	
Macros (60)	Excellent	Good	Good	Good	Excellent	Good	
Consolidation and							
Linking (60)	Excellent	Satisfactory	Excellent	Satisfactory	Very Good	Very Good	
Capacity (60)	Very Good	Very Good	Very Good	Good	Good	Good	
Documentation (70)	Excellent	Excellent	Excellent	Satisfactory	Excellent	Very Good	
Ease of learning (50)	Excellent	Very Good	Very Good	Satisfactory	Very Good	Very Good	
Ease of use (100)	Very Good	Very Good	Excellent	Good	Excellent	Good	
Server installation (60)	Very Good	Poor	Very Good	Poor	Very Good	Very Good	
Resistant							
Support policies (20)	Very Good	Very Good	Very Good	Excellent	Very Good	Satisfactory	
Technical support (20)	Good	Satisfactory	Satisfactory	Very Good	Very Good	Satisfactory	
Value (100)	Excellent	Very Good	Excellent	Good	Excellent	Very Good	
Final Scores	8.6	6.6	7.9	6.0	8.5	6.7	

When InfoWorld tested and compared six different, high-end PC spreadsheets, QUATTRO PRO outscored them all.

We won't throw you any learning curves

QUATTRO PRO is 1-2-3-compatible, so you'll feel right at home, right away—using 1-2-3-compatible menus and commands.

Borland's new VROOMM™ (Virtual Runtime Object-Oriented Memory Manager) technology gives QUATTRO PRO the power to read and write even the largest 1-2-3 release 1A or 2.01 files and macros, and Symphony files



Attention 1-2-3 owners!

Step up to QUATTRO PRO now for only \$99⁹⁵ risk-free. Proof of ownership (an original page or disk from any version) is required whether you purchase from Borland or your dealer.

TO ORDER:

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- OR CALL TOLL-FREE: 800-331-0877, 7 A.M. to 4:45 P.M. (PST).
- BY MAIL: See information below*

B O R L A N D

CODE: MQ44

*To order by mail, please send your name, company, address, phone number, credit card number, expiration date, and signature (or pay by certified check or money order) to Borland International, Inc. QUATTRO PRO Upgrade, P.O. Box 680005, Scotts Valley, CA 95067-0005. Purchase price is \$99.95 (suggested retail price) plus \$5.00 for shipping. CA, CT, NY, GA, PA, TX, VA, WA, MI, IL, and MA residents, please add sales tax. Offer good in the United States and Canada only. Limited time offer. Clip art from Picture Paks by Marketing Graphics Inc. QUATTRO PRO and Paradox are registered trademarks and VROOMM and Hot Link are trademarks of Borland International, Inc. Copyright © 1990 Borland International, Inc. All rights reserved. BI 1352

CIRCLE 377 ON READER SERVICE CARD

Computers, FCC Class A, Class B, and You — or When is it better to get a B than an A?

You need to know the difference between computers that meet the FCC class B radio frequency emissions standards and those that meet only the Class A standards.

Computers emit radio signals in their operation. Because these signals may cause interference to radio and television reception, the marketing and the use of computers is regulated by the Federal Communications Commission. Under federal rules, computer users are responsible for remedying interference, including interference in neighboring homes.

Computers certified by the FCC as meeting the Class B standard are less likely to cause interference to radio and TV reception than those that have been verified by the manufacturer or importer to the Class A standards. Only Class B certified computers may be advertised, sold, or leased for use in residences. A similar regulatory program applies in Canada.

Buyers seeking computers for use in homes (including offices at home) should shop for computers and peripherals which have been Class B certified. These devices carry a label with an FCC ID number. Both new and used Class A verified devices may be sold only for use in commercial and industrial locations. Signals from computers are more likely to be masked by electrical noise from other equipment in such an environment. These areas are also likely to have fewer radios and TVs. Accordingly, equipment marketed only for use in these locations may meet the less rigorous Class A standard. Class B certified equipment may be marketed for use in residences as well as commercial and industrial locations.

As you shop for a computer for use in your home, look for the FCC classification in the specifications or ask your vendor to recommend only machines that have been certified to the Class B limits. TV viewers and radio listeners in your home and in neighboring homes will be glad you did.

New & Improved

IMPROVED

CONTINUED FROM PAGE 54

integrated into the standard dictionary upon installation.

Microsoft Word Supplemental Dictionary Kit for foreign listings retails for \$75, the medical and legal dictionary kit costs \$49.95. There is also a \$5 shipping fee with each order. To order the dictionaries, you should contact the Microsoft Corp. Information Center at (800) 426-9400. Microsoft Corp., Redmond, Wash.; (206) 882-8080.



Graph-in-the-Box Executive captures data to create charts. This spline graph was taken from *Lotus 1-2-3*.

Graph-in-the-Box Executive—New England Software's *Graph-in-the-Box Executive* incorporates the features from the original *Graph-in-the-Box* and *Analytic* packages as well as 15 new charts, including previously unavailable text and organizational charts. It also includes nine new fonts, and three-dimensional effects.

In addition to its graphing features, *Graph-in-the-Box Executive* offers 57 data manipulation functions and statistical functions, including standard deviation, variable proportion, largest and smallest value, and linear, logarithmic, and exponential trends. A TSR that captures data from any character-based application, *Graph-in-the-Box Executive* senses which video adapter is in your PC to automatically provide the highest resolution up to VGA. *Graph-in-the-Box Executive* retails for \$299.95, with upgrades from *Graph-in-the-Box* and *Analytic* packages available for \$119.95. New England Software, Greenwich, Conn.; (203) 625-0062.

VP Manager—Aristocad has added a new software-enhancement package to its product line. Formerly Logical Solutions' *The Desktop*, *VP Manager* is a document and file manager for *Ventura Publisher* that allows users to manage the files created by *Ventura Publisher* through an icon- and menu-based interface.

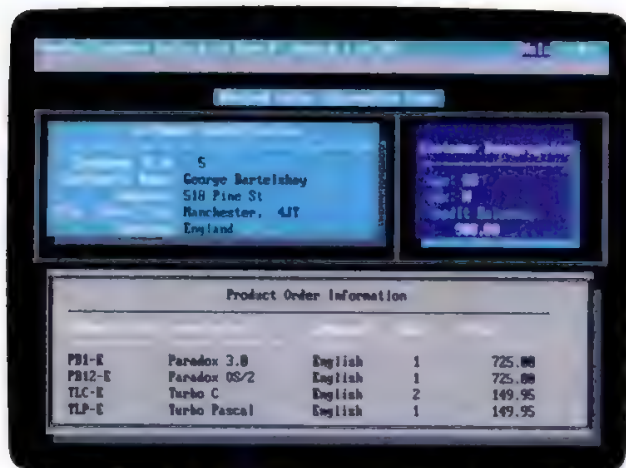
With its document management feature, users can identify the contents of any *Ventura* chapter file; add descriptive notes to files; assign document categories and keywords; record job-tracking information; and maintain a history of file updates. *VP Man-*

ager's file management functions make it easier for you to move, copy, rename, and delete chapter files or file components. Users can also obtain date, size, file attributes, and disk information for both local and network drives. The report-generation function facilitates report making on any file chapter with *VP Manager's* query function. Other features are a timed backup function, for safeguarding your desktop publishing, and a file locator. *VP Manager* lists for \$149, and requires *Ventura Publisher* and Hercules, EGA, or VGA display system. Aristocad Inc., Milpitas, Calif.; (408) 946-2747.

Brief, Version 3.0—Solution Systems' update of its programmer's editor incorporates a new C-like macro language, CBRIEF, allowing users to write macros without having to switch between C and a different macro language. *Brief 3.0* has a translation function that allows users to convert code back and forth between the original C syntax and CBRIEF. *Brief 3.0* also adds enhanced debugger capabilities with a new macro language source level debugger that works with both the original *Brief* macro language and CBRIEF. Additional improvements include multiple keystroke macros which can be saved, edited, and restored as well as improved template editing and indenting for ADA, Cobol, BASIC, FORTRAN, Pascal, and C. *Brief 3.0* also adds the ability to save and restore window setups. *Brief 3.0* is available for \$199, plus \$6 shipping fee. Upgrades for registered users are available for \$70. Solution Systems, South Weymouth, Mass.; (617) 337-6963, (800) 821-2492.

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Multitable form dynamically displaying information from three related tables.

You don't have to be a programmer to have easy access to our highly sophisticated, powerful relational database, Paradox® 3.0.

Paradox 3.0 is all-powerful and never painful because it makes all the complex inside moves, you don't. While it does the complex for you, the complexity is hidden beneath clear, natural, even intuitive pathways and patterns that make life easy for you.

With Paradox 3.0, there are no Unclears, no Unknowns. You don't need an army of in-house technical support people. And best of all, you *don't have to be a programmer* to be a pro with Paradox. It's all gain, no pain.

✓ "Query-by-Example" for example

Use this checkmark and you're using QBE.

It's that easy. Let's say you need to know in a hurry which of your Los Angeles customers bought more than 5 pairs of white shoes. First ✓ the customer field, then type "LA," "white," and ">5," and you're done. Paradox gives you the right answer, right now. And how much programming to do all that? Zero.

If your database experience so far is limited to the flat-file type rather than relational, or even if a

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September 23, 1988



spreadsheet is the only program you've used before, Paradox gets you up and running immediately with just a ✓.

Record-locking and Auto-Refresh make the network safely network

Paradox has become the leading networker because it handles multiple users intelligently. If someone in your group or network has accessed a record, automatic record-locking keeps everyone else from changing it.

That way, two or more people can't change the same data at the same time. (As a bonus, Paradox also tells you *who* is using a record at a particular instant.)

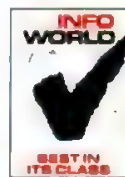
Once the record has been changed by someone in the network, *Auto-Refresh* kicks in *automatically* and updates everything. Everyone in the network is looking at up-to-the-minute information.

Paradox, for the looks of things

Presentation-quality graphics are another Paradox distinction. They give you and your work the professional look.

Paradox instantly turns your tables into graphs with *one* keystroke—and in multiuser environments, with a few keystrokes your graph can show up-to-the-minute changes. Not only does everyone get the picture, they get an accurate picture.

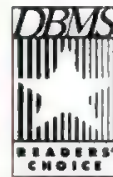
The Real Winner



JAN. 8, 1990



September 26, 1989
Paradox 3.0



NOVEMBER 1989



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Code: MX25

CIRCLE 147 ON READER SERVICE CARD

\$695
suggested list price

If it starts here, fax it from here.

It was recently estimated that 80% of all faxes start on a computer. A telling statistic indeed. And what it may be telling you is that it's much more convenient to fax directly from your PC.

The Intel Connection CoProcessor (CCP) enables you to do just that, simply by snapping this add-in card into your PC. The transformation is phenomenal.



With the CCP, you can send and receive faxes without leaving your computer or the application you're working on. Thus you can share data, text and graphics with PC and non-PC users alike. Send faxes at one time to

one person or one hundred. Best of all, the CCP works in the background so you can keep using your PC while transmitting faxes.

That's just the beginning of the benefits. Because your documents aren't sent from a fax machine, they arrive looking crisp and clear. They're also easier to keep confidential because they're not lying around in your fax basket. And you'll never have to wait in a fax line again.

Call Intel at (800)538-3373 and we'll tell you all about this award-winning product and its industry-leading five-year warranty. Or call our round-the-clock, automated FaxBack line (503)629-7576 and ask for document #9994. Please have your fax number handy.

Either way, do it today. It could be the start of something great.

intel[®]

New & Improved

Pacific Data Memory Board for IBM LaserPrinter 4019

NEW

The LP Memory expansion board from Pacific Data Products can increase memory on the IBM LaserPrinter 4019 up to 3.5MB. The LP Memory takes advantage of the built-in memory manager on IBM's LaserPrinter 4019, allowing users to download software fonts and forms and to print complex graphics images. Memory not used for fonts or bitmaps becomes a spooling buffer, which along with the IBM printer-sharing option allows up to six PCs to share a single printer. The LP Memory provides faster job processing for standalone users in addition to multiuser flexibility. The LP Memory uses 4- by 256-kilobit DIP memory chips.

List Price: LP Memory, \$395 with 1MB, \$595 with 2MB, \$895 with 3.5MB. Pacific Data Products, 6404 Nancy Ridge Dr., San Diego, CA 92121; (619) 552-0880.

CIRCLE 443 ON READER SERVICE CARD

Office Minder Brings Information Management, Communications to LANs

NEW

Advanced Concepts' Office Minder software, combines electronic mail, schedule and project minders, electronic filecard system, text editor, and auto-dialing with LAN operability. Other features include screen capture and attachment and ASCII import and export. Office Minder works with any DOS-based network, including Banyan VINES, LAN Manager, and 3Com.

Office Minder uses Message Handling Service protocols to optimize its use on Novell networks. Office Minder's electronic mail capacity includes server-to-server and inter-LAN communications between networks that incorporate MHS. MHS is transparent to the user; Office Minder communicates with other LANs in the same way that you would send e-mail to another PC in your local network. Office Minder is a TSR that runs in 60K.

List Price: Office Minder, \$695 per server for an unlimited number of users. Advanced Concepts Inc., 4129 N. Port Washington Ave., Milwaukee, WI 53212; (414) 963-0999.

CIRCLE 446 ON READER SERVICE CARD

The Bread Board System (*tbbs*) Information Manager provides high performance multiuser electronic mail, custom databases, or protocol file transfer on a single PC using only DOS. No LAN or multitasker.

Using menu templates you can tailor the system to your exact needs. Move beyond multiuser bulletin boards by adding The Data Base System (*tdbs*) expansion module to allow custom multiuser dBASE programs as well.



Up to 32 lines and still easy to use

Mix local and remote lines at speeds up to 19,200bps.

16 user *tbbs* \$895. Also available in single and 32 user versions. Available now for immediate delivery.

Call for more information and access to a demonstration system (303) 699-6565.



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easy-to-follow
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The possibilities for custom information systems have never been greater. *tbbs* and *tdbs* allow a level of performance and ease of implementation never before available at any price. You get rapid custom system development combined with the reliability inherent in the low complexity single CPU and DOS only environment. Experience the power and control only *tbbs*/*tdbs* can provide.

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Big Deal?

"Sure it looks great in the labs, but how does it hold up day after day?" DATAWORLD computers emerged among the top four systems evaluated in a new six-month marathon endurance test specifically designed to run "notoriously finicky software and swapped add-in boards". Our machines were selected because they have been named 1989 Editor's Choice on several occasions.



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DATA 386 SLIM-LINE SX \$1398



"LANDMARK Ver. 2.0 Rating: 21MHz"

- Intel 80386SX 16MHz CPU – 2MB RAM
- 80387SX coprocessor socket
- EMS 4.0 driver
- Expansion slots: 3 16-bit and 2 8-bit slots
- 1.2 or 1.44MB diskette drive
- VGA output with 800x600 resolution
- VGA monochrome monitor
- 1 PAR/2 SER PORTS

DATA LP/SX \$2795



BASE CONFIGURATION W/40MB DRIVE (VGA GAS PLASMA)

- Intel 80386SX-16 CPU
- VGA gas plasma display, 640x480 resolution with 16 shades
- External VGA monitor port
- 1MB of base RAM, expandable to 4MB with memory daughterboard
- AMI BIOS with ROM setup and diagnostics
- Expansion slots: 1 half-length slot available
- 1.44MB diskette drive (external 1.2MB drive connector built-in)
- 40MB, 25ms hard drive (IDE interface)
- 1 parallel and 2 serial ports
- 87-key keyboard (external keyboard connector port built-in)
- 65W power supply
- Carrying case
- Weight: approx. 15lbs.

DATA 386SX \$1095



- Intel 80386SX 16MHz CPU (Norton SI ver 4.0: 18)
- 1MB RAM standard, expandable to 8MB on motherboard
- 80387SX coprocessor socket
- Expansion slots: 6 16-bit and 2 8-bit
- 1.2 or 1.44MB diskette drive
- 200W power supply
- Monochrome card and monitor
- Options include hard disks from 20MB to 700MB, tape backup, modem, mouse, Wordperfect key caps, DOS, extra floppy, monitors, game card, coprocessor and tower case

COMPARE THESE VALUES
REPORTED IN
JAN. 30, 1990
ISSUE OF PC MAGAZINE

	Instruction Mix	Roating Point Calculation	Conventional Memory
DATA SLIM-LINE SX	4.08	6.98	0.49
IBM PS/2 Model 55SX	4.46	8.46	0.83
Compaq Deskpro 386S	4.48	9.67	0.83

	Instruction Mix	Roating Point Calculation	Conventional Memory
DATA SLIM-LINE SX	4.08	6.98	0.49
IBM PS/2 Model 55SX	4.46	8.46	0.83
Compaq Deskpro 386S	4.48	9.67	0.83

All systems comply with part 15 of FCC rules for a Class A or B computing device. As such, they are suitable for use in a business environment.

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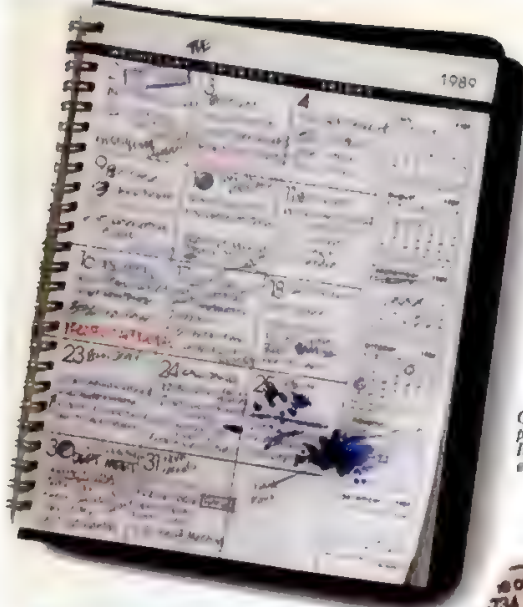


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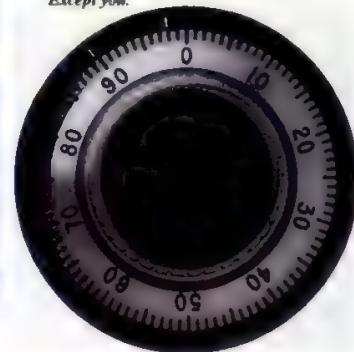


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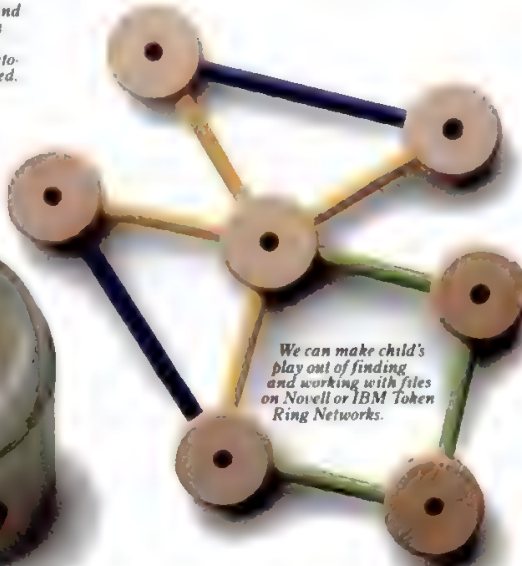


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CIRCLE 749 ON READER SERVICE CARD

by
Gus Venditto

Pipeline

A Look at the Trends Shaping the Personal Computer Market

Wireless LANs and WANs Try to Cut Through the Noise

In the never-ending quest to find the perfect data medium, an increasing number of developers are looking beyond today's tangled cables toward schemes for moving bits right through thin air.

Ardis, the partnership between IBM and Motorola, recently gained widespread coverage when it unveiled a national network of radio transceivers.

Ardis customers can link portable computers with a host by transmitting over Ardis's local radio frequencies. The newly formed company sells access to a network of transceivers and land lines that took years and millions of dollars for Motorola to build. The network covers the entire country, providing access indoors and out, maintaining dozens of stations in every large

city to ensure adequate coverage. Most significantly, though, Ardis has FCC licenses for its own dedicated radio frequencies in every metropolitan area.

A handful of smaller companies are focusing considerable attention on a small part of the crowded radio spectrum that the FCC keeps open for public use to provide low-power, in-office radio LANs. Agilis of Mountain View, California, and Telesystems of Don Mills, Ontario, Canada, are industry pioneers in using a technique called spread spectrum radio to tie PCs into

standard LANs inside office buildings.

PCs in these LANs transmit data packets across one of three narrow radio bands at 1 watt; receivers at the server reconstruct the data packets. Because the transmission is spread out across the available spectrum, it's less susceptible to interference: if a particular frequency is not clear, the system will transmit at a different frequency. Error correction protocols are used to ensure that data packets are received intact; if an error is detected, the

CONTINUES ON PAGE 64

WordPerfect 5.1
WordPerfect Corp.

Quicken 3.0
Intuit

Lotus 1-2-3 2.2
Lotus Development Corp.

PC Tools Deluxe 5.5
Central Point Software

TurboTax Personal
Chipsoft Corp.

Microsoft Works 2.0
Microsoft Corp.

ProComm Plus
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Carbon Copy Plus
Microcom

The Norton Utilities,
Advanced Edition 4.5
Peter Norton Computing

Fastback Plus 2.01
Fifth Generation Systems

READING THE CHART

The Top Ten Sellers list ranks PC business programs according to their sales totals in the week ending February 3. The charts that appear to the left of each program name show how the program's sales ranked each week for the last five weeks. The hash marks at the bottom of each chart represent each of those five weeks, beginning with the week of January 2. Dramatic shifts in a particular program's ranking may be the results of sales promotions conducted by individual retailers. Seasonal factors, such as end-of-year budget purchase decisions, can also play a large role in the performance of a particular program in any period. More than 12,000 individual locations contribute to the list.

Sales information compiled by Ingram-Micro D and PC Connection Inc.

Rankings are based on net shipments by unit; returns are subtracted from gross shipments.

TOP TEN SELLERS — A FIVE-WEEK HISTORY

This week marks the second 1990 appearance of *TurboTax* on the Top Ten Sellers list. *TaxCut* from MECA Ventures is giving *TurboTax* a run for its money this year, though not enough to get *TaxCut* into the Top Ten. While tax software programs first appear in stores in late December every year, traditionally it's not until early February that the publishers ship the fully debugged final versions of their products. This week's list reflects those early February shipments.

Pipeline

CONTINUED FROM PAGE 63

system tries again.

It's a technique proven reliable by U.S. government installations that have used it for years, but spread spectrum radio LANs have to prove feasible when used in an imperfect office environment that's full of emissions from leaky fluorescent lights, sparking elevator motors and even passing radio-dispatched taxis that are broadcasting outside their licensed range. And if two radio LANs are ever installed in the same building, it could take weeks to find and resolve the conflicts.

Both companies claim throughputs of 230 kilobits per second when running Ethernet.

Taking a page out of a 007 script, other developers are using laser beams to bridge networks across open spaces.

(As of this writing, tests of both systems were just getting underway at the *PC Magazine* LAN Labs; a comparison review is scheduled for the June 12, 1990, issue).

Taking a page out of a 007 script, other developers are using laser beams to bridge networks across open spaces.

Laser Communications in Lancaster, Pennsylvania, has a family of laser links that can connect networks across a half-mile distance. The coherent light beam is a safe (or what the manufacturer calls "virtually harmless") 20 Mw and needs only a clear line of sight between transmitter and receiver to get data moving.

Systems are available to pro-

vide 10-Mbit/second Ethernet, 4-Mbit/second Token-Ring, 1.544-Mbit/second T1 or 6.132-Mbit/second T2 links.

The company certifies the setup for all weather conditions.

Finally, and potentially most problematic, are schemes to flash bits via infrared light. Photonics is selling infrared devices that plug into a PC or Mac via RJ-11 cable and clip onto an office cubicle. Uninterrupted sight lines are required, though the company makes cable available to connect walled-in nodes.

Other companies are experimenting with infrared schemes that disperse the signal by bouncing it off floors and ceilings.

With increased demand for radio frequencies, wireless communication is unlikely to have a major impact without FCC action. As the government grapples with high-definition television's requirements and growing congestion on cellular phone channels, it's unlikely that more space will be freed for spread-spectrum radio LANs or dedicated-frequency WANs.

The most promising long-term technology for wireless communication is a cellular network that shares the spectrum reserved for today's cellular phones. Until the FCC allots more bandwidth for this purpose, however, progress will be stymied.

Which NeXT Step Is That? IBM Muddles Unix Standards Again

IBM finally committed itself to the operating system it licensed from NeXT Computers last year. It's unlikely to affect PC users, although some critics believe it will.

NeXT Step will become an operating system choice for IBM's new workstation line. Some Unix developers are pleased that IBM has thrown its weight behind an emerging Unix standard; others are confounded by the company's half-hearted support for the Open Software Foundation's choice of Motif, a combination of an OS/2 Presentation Manager front end and DEC's X Windows programming interface.

One critic has gone so far as to claim IBM's endorsement of

NeXT Step is a repudiation of its commitment to SAA and OS/2. Don't believe it.

By offering the choice of an SAA-compliant AIX that adheres to the OSF/Motif interface or a NeXT Step interface for AIX, IBM is proving that it wants to win a significant share of the workstation market and

it's open to any method that will carry it to victory.

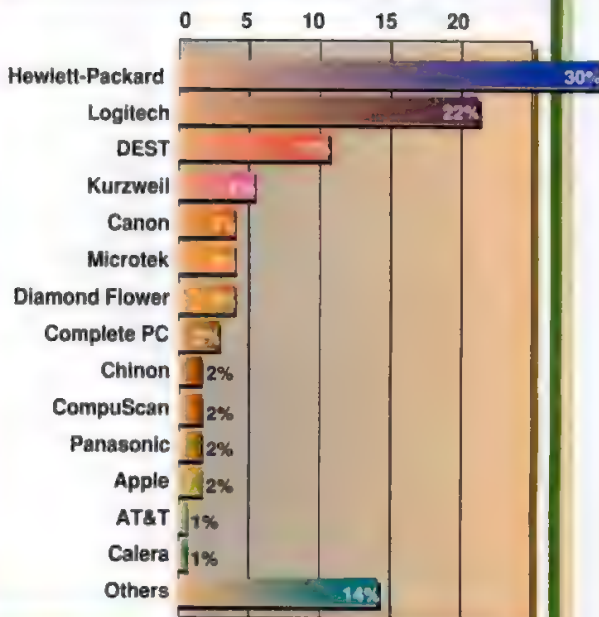
If the OSF/Motif choice becomes dominant, that's a big win for SAA and IBM's enterprise-wide strategy. If the NeXT Step interface becomes popular, workstation users will become even further isolated from PC software.

MAGNET SURVEY

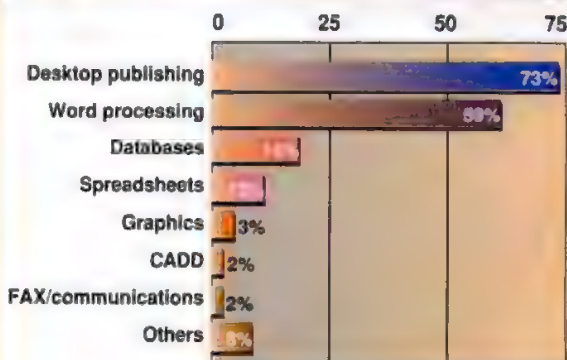
When we asked 1,085 callers to PC MagNet if scanners were used in their offices, 52 percent said they were.

Although capturing graphics was the most common use for the scanners, a strong percentage said that text recognition was an important function, too. Twenty-eight percent of the total respondents said they were planning to obtain a character-recognition scanner within the coming year.

Which optical scanners are used by you or others at your company?



Which applications do you use scanned data for?



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**Like everything else,
the wild pace of
change in the PC
market has always
been spurred by
new ideas. Get ready
for more change.**

Everything good has already been invented. Except in computerdom. There, scientists and engineers keep the pot boiling as they invent and perfect new technologies. The price-performance curve gets a constant workout as products are continually infused with new ideas and abilities. This market is still quite susceptible to a good new idea, and I see plenty of them.

One of the hottest new technologies is flash EEPROM, or Electrically Erasable Programmable Read-Only Memory. It combines the best attributes of ROM and RAM by holding its data after the power is turned off and by being rewritable while in the computer. Flash memory is technologically seductive, because like dynamic RAM, the memory bits are small and can be packed tightly together.

Unlike dynamic RAM, flash memory doesn't forget its contents when you turn off the power. The "flash" designation refers to the command that can erase the entire chip or a disk-sectorlike portion thereof. This chunk-at-a-time approach makes it unsuitable for main memory, good for solid-state disks, and excellent for updatable ROMs.

From the time I first wrote about flash memory ("Building Better Memories," *PC Magazine*, June 28, 1988), engineers have been working feverishly on getting it to be more reliable. Flash EEPROM, like most erasable ROMs, was initially good only for about 100 reprogrammings. After that the insulating layers that store the bit patterns began to wear out, and errors crept in. Some new flash memories are good for as many as a million reprogrammings.

Psion is taking the plunge on flash memory by using it as nonvolatile solid-state disk storage on its new laptops. Another as-yet-unannounced notebook computer will store the ROM BIOS and perhaps even DOS in flash memory. Notebooks such as the NEC UltraLite have the advantage of near-instant-on operation because they boot from ROM instead of having to wait for a disk drive to spin up to speed. The UltraLite's ROM, however, is not updatable, except at great expense. Upgrading the installed base is a near impos-

sibility. Booting a hard-disk-equipped notebook from flash memory provides the best of both worlds: DOS loads while the disk comes up to speed. And the user can take advantage of upgrades, new versions, and bug fixes.

FAST FUTURE

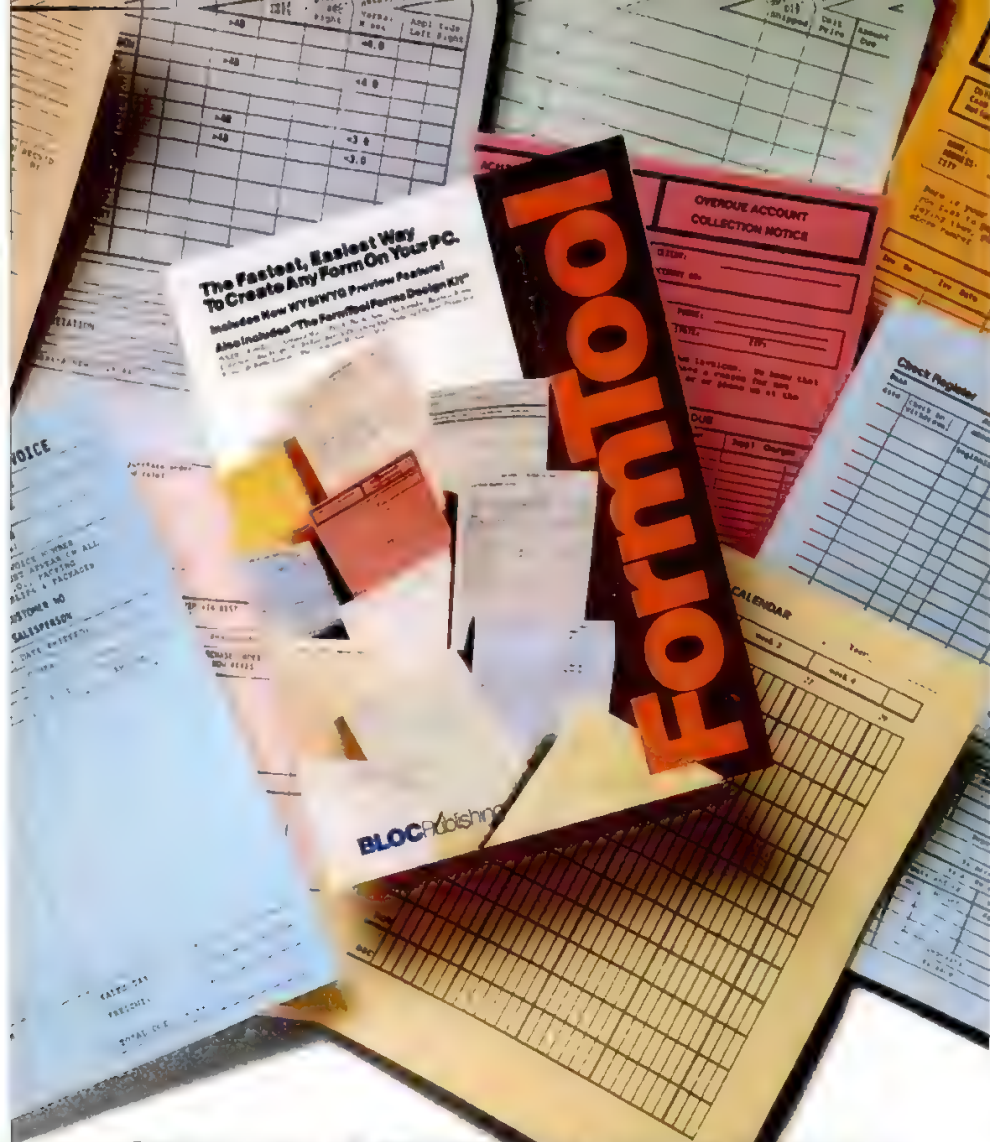
Connectivity mavens are abuzz over FDDI, the Fiber Digital Device Interface. It offers a dazzling 100-megabit-per-second transfer rate over fiber-optic cable. At the moment, it's being targeted at LAN backbone systems and for interserver connections. Fiber is attractive for a number of reasons beyond its breathtaking speed. The most important is that it doesn't produce radio emissions. Given the FCC's fractiousness these days, that's critically important. It may lead some manufacturers to interconnect the various elements inside their machines with fiber instead of the buses and cables we're used to. High-performance processors such as electronic telephone switches



ILLUSTRATION: JEAN-FRANÇOIS ALLAUX

are already built this way; it's only a matter of time before the technology finds its way into high-end PCs.

By the time it gets there, however, it may be obsolete. Gazelle Microcircuits has introduced a new chip set called, appropriately, Hot Rod. It takes data from a 32-bit bus and pumps it over the cable at gigabit rates. That's a billion bits per second. Gazelle says that's barely adequate to handle the data stream that a 33-



Bill Machrone

MHz 80386 is capable of producing, never mind what happens when you have multiple processors. So Hot Rod II is in the wings, and it's capable of jaw-dropping 10-gigabit transfer rates.

Manufacturers of file servers are already producing machines that take advantage of EISA and Micro Channel for high-speed internal transfers. The result is machines such as Compaq's Systempro, which is all but unsaturable in normal applications. Imagine EISA bus speeds that don't have to stop at the file server or even between file servers. Think about the impact of having full-speed access to any device on any part of the network. We're talking machine-to-machine transfers at rates reserved for processor-to-cache transactions today. When you couple that with the inevitable rise in processor speed and power and dramatically increased density in both disk and memory, the future looks bright, indeed.

PEGGY SUE'S PC

Remember Kathleen Turner's summary of future high-tech products in "Peggy Sue Got Married"? As she put it, "Everything gets smaller. Except radios. They become enormous."

Products such as the Poqet PC have already shown that the only limit on a computer's size is the human interface. The keyboard can't be smaller than our fingers and the screen can't be smaller than roughly the size of a paperback book. Everything else is up for grabs.

By way of example, outfits such as Conner Peripherals, PrairieTek, JVC, and Areal Technology are locked in a can-you-top-this spiral of ever-smaller, denser disks for portable computers. Areal's latest is a 50MB drive sporting a single glass platter that measures a mere 6/10 of an inch thick. The benefits to those who do their computing on the run are obvious, but the technology will doubtless find its way back into desktop machines.

The wild pace of change in the personal computer market has generated confusion from the beginning. The key to success remains in sorting out the best path for yourself and your company. Given the new technologies and choices ahead, it won't get any easier. We'll all have a tough enough time just keeping the acronyms straight.

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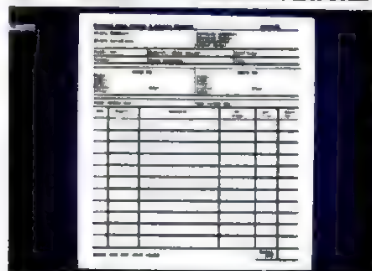
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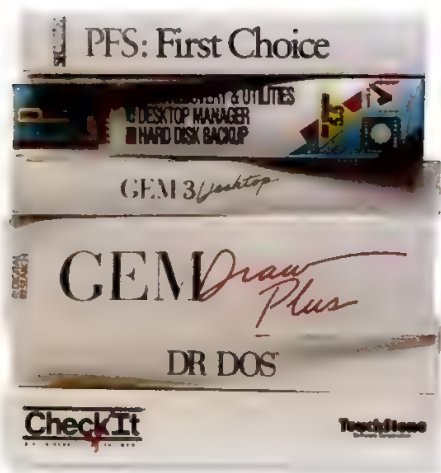
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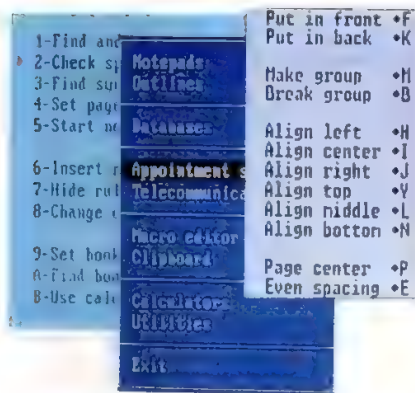
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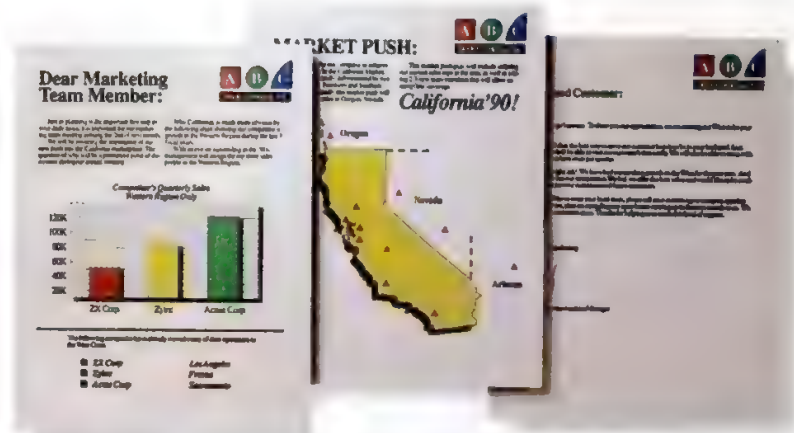
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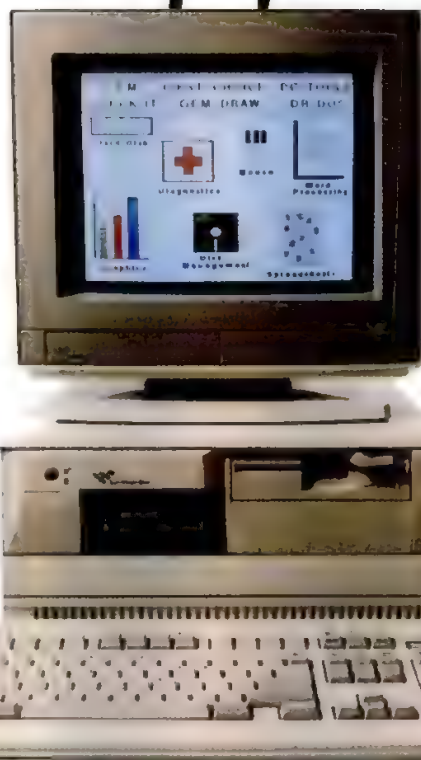


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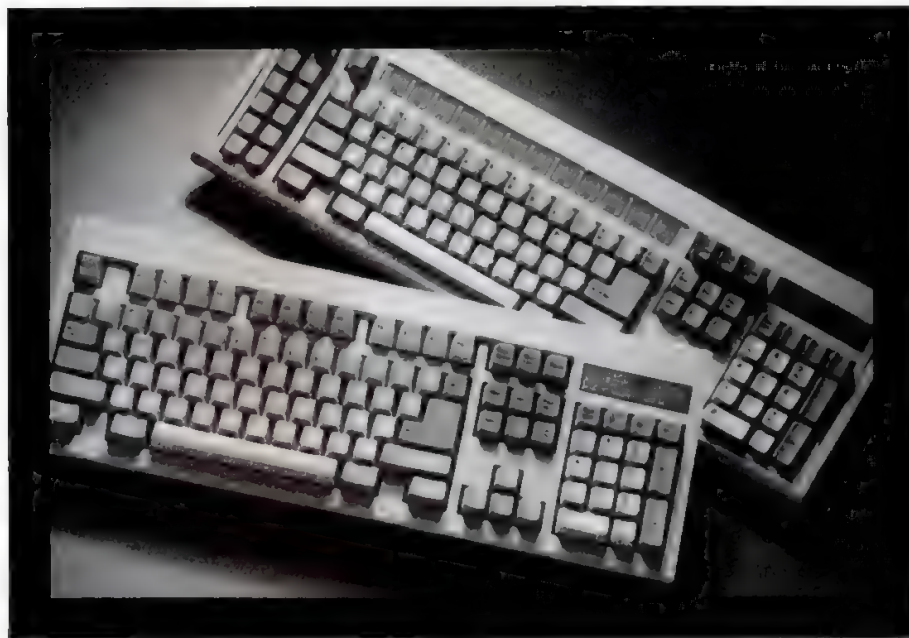
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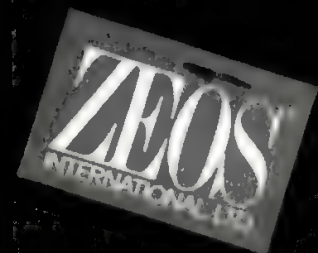
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CIRCLE 388 ON READER SERVICE CARD



John C. Dvorak



**When RISC takes
over the PC
market, the best
chip fabricators
will make the
fastest chips and
the most money.
That prospect
doesn't sit well
with Intel.**

What is RISC to you and me? More than a chip that executes fewer instructions more efficiently, the RISC microprocessor is heavily into on-board high-speed caches, removal of microcode, and other modern efficiencies. The basic problem with RISC is bad press. Expect that to continue for the next few years.

Most designers will tell you that every aspect of RISC design so threatens the status quo of the computer world that vested interests have begun a campaign to stall, as long as possible, a complete change from CISC ideas to RISC ideas. The reason: a fear of the impact that move will have on high-end mainframes and minis.

Some observers see RISC as a springboard to performance increases that will occur so rapidly that they will infringe on the big machines' turf and wreak havoc in the industry. "Companies won't be able to lay off workers fast enough," I'm told. The successful CISC makers, Motorola and Intel, will be crushed by performance increases they cannot duplicate. Worse, Intel, which has relied on its quasi-monopoly position by not competing with its own licensees anymore, may have already fallen behind in fabrication technologies. Evidence of this first appeared when both Harris and AMD showed up Intel by making the 286 better than Intel could make it.

When RISC takes over the market, the best chip fabricators will make the fastest chips and the most money—a prospect that doesn't sit well with the big boys. It's become such a threat that executives from Intel call RISC "the enemy."

The situation is complicated by an interesting aspect of RISC: the removal of microcode from silicon and the placement of it in software where it belongs. With RISC, the space allocated to microcode becomes a cache, and suddenly all applications run as fast as microcode (since they are loaded into cache that runs at microcode speed). Once microcode is taken out of the chip and placed in software, it also becomes "open," and software vendors can optimize communications with the chip in new ways. They're not limited to the canned and dubious CISC instruction set used by chips that are forced to be forever compatible with the 8088.

The first collection of RISC-based PCs will have to have a coprocessor to be cheaply compatible with old software. This is nothing new. In 1981 when the PC was introduced into a world filled with CP/M machines, it had a board called Baby-Blue that ran CP/M on an on-board Z80.

RISC-Y BUSINESS

Whatever you call it, the monster players like IBM cannot deal with an industry where power increases threaten the big iron. By the year 2000, cheap RISC designs will bury the market for expensive minicomputers and low-end mainframes. Only the supercomputer will survive the great market implosion.

The strategy? Downplay RISC. Ignore it and hope it will go away. Intel is going to make as much dough as it can with the 386 and 486 before it has to change its business. I predict that the 80586, if it ever comes to market, will find few takers. Intel may suspect this, too. Already it's involved heavily in the systems business as a possible hedge.

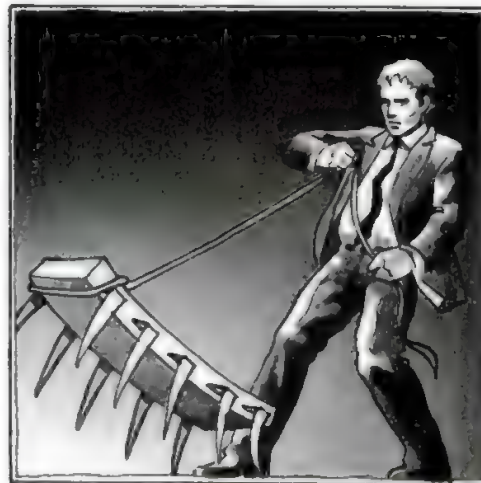


ILLUSTRATION: JEAN-FRANÇOIS ALLAUX

Despite propaganda and wishful thinking, the change will happen, and it will come from users like you and me. Once RISC comes down to the PC level and machines can be had for less than \$5,000, it will be all over for CISC and any other resistant factor. The big iron companies will be restructuring into the next decade to adjust for a massive shift in the cost/performance curve. It will be ugly.

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Supports only C.

Ashton-Tate SQL Server's published benchmarks show it to be slower.

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John C.
Dvorak

Inside Track

Are we going to see the reemergence of **Digital Equipment Corporation** into the PC arena? Now that

the company is starting to do image advertising à la IBM on TV, this possibility may become a reality, with better results than the last time it tried. DEC's first attempt was stymied by lack of brand name recognition and poor decision making. The company is rumored to be **recoding its fancy VMS operating system** into C for portability. First, Digital will put the OS on the MIPS RISC chips. Once the operating system is recoded, it could show up anywhere.

Intel Watch Dept.: While all this goes on, Intel has been quietly making systems, mostly as an OEM and for large national accounts. Since Intel makes the chips, it has vertical integration going for it and should be able to **underprice** the competition. One source claims that Intel has already **sold nearly a half million systems** in one way or another. This side business seems to be controversial, since companies like Compaq that are major purchasers of Intel chips now have to compete with Intel systems. If a shortage of Intel parts occurred, I wonder who'd get priority treatment?

Modem Standards Dept.: The hottest thing going on in the world of modems and FAX modems is a new ANSI standard designed to extend the ubiquitous "AT" command set to include FAX modems. Expect to see PC FAXs use a **FAX extension** called TIFF Class F, which will allow FAX transfer of **TIFF files**. Also slated for deployment around 1992 will be a new FAX standard that will **jump the speed** from 9,600 to 14,400 bits per second while adding 300/400-dot-per-inch resolution. The new resolution will allow the receiving station to scan the FAX with OCR for conversion to ASCII.

Before that happens, though, you can expect the AT extensions to spark **an improvement** of the FAX/modem card. Before the end of the year we can expect to see those 9,600-bps FAX/modems with a 2,400-bps Hayes-compatible modem replaced by a 9,600-bps FAX/9,600-bps V.32 modem using the new extended AT command set. This standardization means you'll be able to use **generalized FAX modem software** to run your FAX, too—just like communications software is used with various data modems.

While on the subject of V.32 Dept.: V.32, for those of you who haven't kept pace here, is the most widely recognized standard and the one to look for when buying a 9,600-bps modem. The earliest popular standard for this speed was the proprietary HST 9,600-bps modem from **U.S. Robotics**. Even that company has adopted the V.32 standard, and its **hottest modem** is its dual-standard HST/V.32 modem, which sells for \$1,595 for a standalone version. The HST standard

is a must have for those who call a lot of bulletin boards, ever since U.S. Robotics inundated the BBS community with modems at a cheap price to get sysops to adopt 9,600-bps HST. Call Skokie, Illinois-based U.S. Robotics for more information at (708) 982-5001.

Since HST, the primary communication international standards committee (the CCITT) established the V.32 mechanism for high-speed modems, and it seems to have caught on instantly. **I do not recommend** that you buy any high-speed

modem without V.32 compatibility. Also look for **error-correcting** capability called MNP Level 5 (let's call it MNP/5, why don't we?). This capability is bundled with most V.32 modems. Besides doing error-free transmission, MNP/5 enables real-time data compression that can effectively **double throughput** at any speed. An excellent and inexpensive modem of this type comes from **OmniTel** in Fremont, California. Phone them at (415) 490-2202. The modem I currently use is an OmniTel 9632B+. It's an internal 9,600-bps unit

with fallback to 4,800, 2,400, and 1,200 bps with V.32 compatibility and MNP/5 capability—all for \$895. I file a column with the Vancouver Sun in Canada, and this is the only internal modem I've tried that can get me connected on the finicky 2,400-bps port there. My old 2,400-bps **el cheapo modem** wouldn't even link me on the 1,200-bps line to Canada. Anyway, now that Tymnet has 9,600-bps V.32 lines around the country, it's time to boost your speed.

I don't want to finish this discussion without mentioning the **Ferrari of modems**, the Telebit TrailBlazer. This Sunnyvale, California-based company has gone full tilt into a line of PC modems ranging in speed from 300 bps to 19,200. **The most interesting is the Cell Blazer, a cellular modem** that can crank up to 16,800 bps over a cellular link! It sells for under \$1,500. Call Telebit at (408) 734-4333 for information.

Genuinely Interesting Hardware Dept.: If you need some AC in your car to power a cellular modem, a FAX machine, or to charge up your laptop, look no further than the **nifty inverter** from Zirco (10900 W. 44th Ave., Wheat Ridge, CO 80033; (303) 421-2013). Years ago a device like this used to be the size of a lunch bucket. This \$199 instrument fits in the palm of your hand; yet, when plugged into the car cigarette lighter, supplies **100 watts of AC juice**. It's particularly handy for laptops, since it offers full surge protection. If you do a direct DC hookup off a car cigarette lighter to a laptop with a simple lighter-to-laptop cable (available for many laptops) and someone starts the car, you can get a **50+ volt DC spike** that will **ruin many computers**. Buy one of these and avoid the problem. It will work with everything including the TV set. **Highly recommended.** ■

In 1992, new FAX standards will call for 14,400 bps and 300/400-dpi resolution.

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Not only does the Model 12 perform like a desktop PC, it feels like one, too. The AT®-style keyboard provides full-size, full-travel keys that give your fingers plenty of room and great response.

Other advantages include an easy-to-read, backlit LCD screen that your eyes will appreciate. For additional flexibility and convenience, snap on a 3.5" high-density floppy disk drive, or remove it and travel light. Then send work to your office with just a phone call, thanks to an optional internal modem.

The removable 3.5" high-density diskette drive and internal modem are optional.

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As with the Model 12, an intelligent power management system turns off the screen and hard disk drive during periods of inactivity to extend battery life, allowing you to use the laptop longer.

Considering all these features and the performance and versatility they deliver, why would you ever need a desktop PC? For the names of the dealers nearest you, call 1-800-527-3500.

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CIRCLE 347 ON READER SERVICE CARD

Jim Seymour



**Data transparency
is the kind of
interoperability
that really counts.**

Interoperability is going to be one of the hottest buzzwords, and for a change also one of the most important trends in the computer business during the early 1990s. You've seen that word before in these pages and in this column, and I can promise you'll see it here again; interop lies at the heart of the next revolution in PCs.

Yet, as with so many new ideas, it's taken us a while to realize what we really mean by interop, what's most important and what's less so. One of the joys of solving problems (read: coming up with answers) is that the process teaches us so much about the problems themselves (read: asking questions). That's certainly been the case with interoperability.

In the beginning, which as always in this business was just yesterday, a lot of people thought interop mainly meant getting same-name, same-look applications that ran on more than one hardware platform. That was quickly expanded to include "and under more than one operating system," as we began to creep out of the 1980s' MS-DOS consensus into today's much more fragmented OS situation.

But that, we learned, confused what interop really meant. Because the innate advantage of same-name, same-look applications is that you can move back and forth from, say, *PageMaker* on the Macintosh to *PageMaker* under DOS to *PageMaker* under the OS/2 Presentation Manager.

Which is *nice*, but not all that important: how often do you, in practice, move back and forth from one kind of PC to another, doing the same work on both? That reduces training costs somewhat as people trade up, but that kind of platform-to-platform move is usually a one-time, one-direction change. So the return is very modest.

DATA TRANSPARENCY

The kind of interop that we've learned really *does* count is what's sometimes called "data transparency." Symantec chairman Gordon Eubanks got it exactly right a year ago when he said there's too much mumbo-jumbo surrounding interop: all computer users want is "data across platforms."

It's *data* that we really need to move around, frequently, routinely, and as transparently as

possible among a variety of hardware and operating systems. And not at all in just one direction but often ping-ponging it back and forth several times.

That kind of interop has a huge and immediate payoff.

As it turns out, some of those same-name, same-look programs that run on more than one platform under more than one OS do offer transparent data exchange. *PageMaker* not only looks and works alike under the Mac OS, under DOS, and under OS/2 PM, but each of those versions identifies, reads, and works automatically with files created by the other versions.

Mac Excel, *DOS Excel*, and *OS/2 PM Excel* similarly exchange files painlessly. So does *Microsoft Word* in its several versions.

Again, for the purposes of true interoperability, it's almost coincidental that these applications look and work alike on several platforms: what's really valuable is the automatic data exchange.

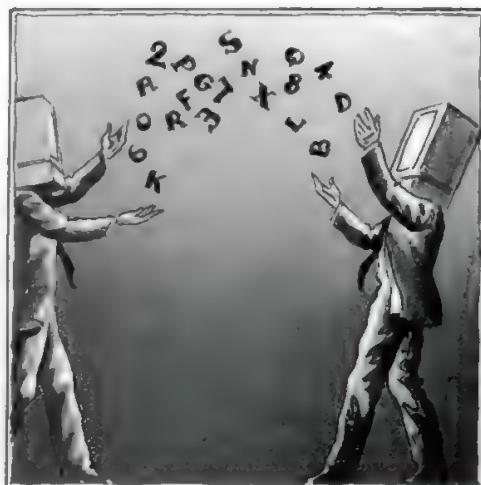


ILLUSTRATION: JEAN-FRANÇOIS ALLAUX

Note that this isn't nearly the same thing as programs that can merely import files from other programs (with or without our intervention) or that can then produce a special "export" file for other programs (with varying degrees of intervention).

Lotus 1-2-3's native .WK1 file format for worksheets, for example, has become a popular interchange format, since publishers of competing programs know that the ability to

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CIRCLE 149 ON READER SERVICE CARD

Jim Seymour

import and export 1-2-3 files is a checklist requirement for corporate buyers. But these other programs don't use .WK1 as their native file format: they merely accommodate it.

If a program can't read data from another program, work with it, and produce a resulting "native format" file that can then be read without special treatment by yet another program, then that program is not truly interoperable.

Today we have several fairly widely accepted and standardized data-interchange formats that allow for moving information from one application to another: AutoCAD's .DXF, .DIF, and Navy .DIF for spreadsheets; the Computer Graphics Metafile .CGM format; and so on. But exporting data to an interchange format, reading it in, and converting it to a program's native file format—and then reversing that journey to pass the results along to someone else—is also not true interop.

SURVIVAL STRATEGIES

And we have, of course, a phenomenal variety of tools today to help us create "brute-force interoperability." These utilities take data from one form and convert it to another; often they're survival kits for harried PC users. Many of them work well enough—but that isn't interoperability.

We spent a lot of time over the past few years worrying about the transport side of the problem: how to get files from here to there. Some of the clever systems developed for moving data from one kind of system to another—devices such as the DaynaFile disk drive for moving back and forth between PCs and Macs, or software such as Lap-Link/Mac, for the same purpose—are very good and remain useful for standalone users.

But local area networks have nearly eliminated that particular problem, especially in midsize to larger firms, by making data-transport nearly effortless. What we thought was a major interop stumbling block was solved for us when we weren't looking.

Now we've got to deal with the need to use data once it's been transported to any of many different kinds of computers.

And that's what true interoperability is all about. ■



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CIRCLE 138 ON READER SERVICE CARD

William F. Zachmann



The growing role of powerful PC-based systems in enterprise-wide information systems brings important challenges, not the least of which is the development of appropriate IS architectures.

During the time when PCs were primarily employed as individual productivity tools or behaved as if they were unusually smart terminals (when linked with mainframe or minicomputer systems), traditional concepts of information systems were not challenged. But the increasing use of PC technology to take on traditional enterprise-wide information processing tasks and the application of newer construction techniques like client/server computing models are changing all that. This scenario is creating tension between established data processing models and the newer alternatives.

A common response to these challenges has been an attempt to reassert the priority of traditional data processing architectures and to bring PCs under control in the organization. That is, in effect, to deny the need for new architectures by forcing everything into old paradigms.

It is also not a very effective response. While a few Neanderthal managers have been persuaded by equally Neanderthal data processing types to try something along those lines, only the most authoritarian can really stop individual users from doing more or less what they want to with PCs and LANs.

Nor does it make sense to try to stop them. Not only do such unenlightened responses fail to prevent users from doing what they want to do anyway, but they undermine motivation and morale and define the most enterprising employees as subversive elements.

Simply put, an organization that does not trust its employees is unlikely to be trusted by its employees. Worse, it is certain not to get the sort of highly motivated effort from its employees necessary to create a high-performance organization—especially one that gains maximum benefit from modern information technology.

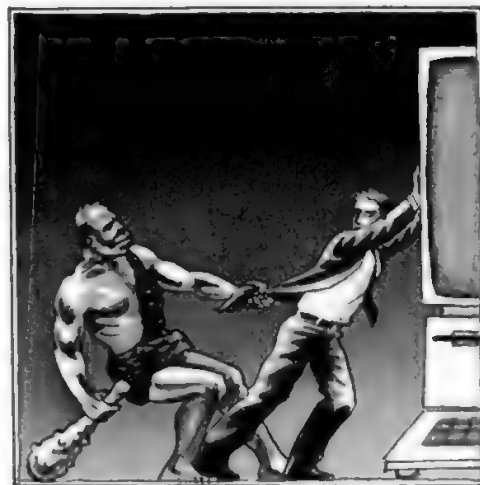
On the other hand, turning everyone loose with whatever PCs, LANs, and other equipment they desire is hardly an adequate response. While that approach might result in some very useful and creative systems, it is probably more likely to lead to unnecessary expense, repeated mistakes, and incompatibilities among departmental systems.

What's more, that approach is certain not to provide a sufficient foundation for the development of true enterprise-wide systems. At best, it will result in leaving traditional data processing systems in place. At worst, it could lead to a complete breakdown in what amounts to the nervous system of the organization.

A BALANCING ACT

As we work to develop new information systems architectures, therefore, we must avoid both extremes. Instead, we must balance the two, preserving the creative tension between individual initiative and enterprise-wide coordination. Neither position can be ignored by a truly effective organization.

Beyond that, we must consider many factors as we develop IS architectures for the 1990s. Not only must future IS architectures allow for continued individual use of PCs as productivity tools, freely, and without undue constraint, they must make room for bottom-up growth of



more-complex application systems at, for example, the workgroup or departmental level. And third, they must be able to make use of new PC-based technology without unnecessarily sacrificing prior investments in traditional mainframe and minicomputer technology.

Any approach to the development of IS architectures that fails to meet these three criteria is inadequate. Together these criteria constitute the *minimum* requirements that an effective

William F. Zachmann

tive IS architecture schema ought to be expected to meet.

What's more, it is only when an organization accepts these criteria that it can begin to identify some of the more promising strategies that might lead to the development of an effective IS architecture.

ture. Let's examine a few of them.

First, it is all but certain that these criteria simply cannot be met without a well-defined, yet *parsimonious*, use of standards and *recommended practices*.

For standards, while a necessary element in meeting the third criterion, can readily violate the first two if they are not used frugally and supplemented by recommended practices. They can all too easily become a bludgeon of conformity

rather than a guarantor of connectivity and interoperability.

STANDARDS AND PRACTICES

Required standards should be kept to the minimum necessary to provide the common basis for different systems to talk to one another. It isn't necessary, for example, that everybody in a company use the same word processing software, only that whatever WP software anybody uses be capable of creating files in formats that can be interchanged with others.

Recommended practices are a necessary supplement to required standards. Support considerations, for example, aren't an adequate reason to require that everybody use the same word processing software. A far better practice would be to recommend a particular program (or choice among several supported packages), while allowing those who prefer others to use them with the understanding that they cannot expect help from the support group if they do.

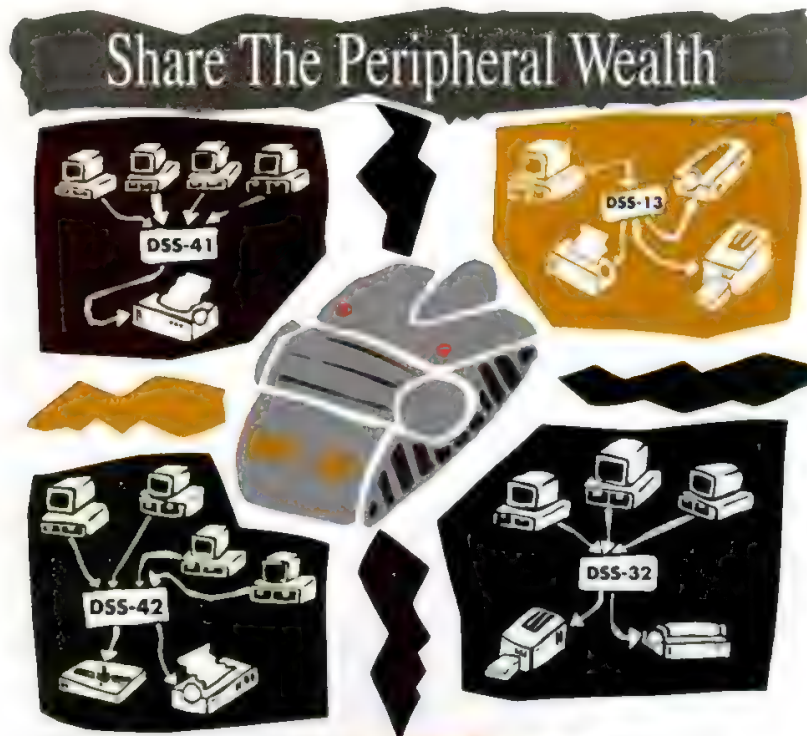
While this example is a fairly simple one, the general principles underlying it can be applied to the full range of standards that might be adopted by an organization.

Another promising approach to IS-architecture building can be found in the data-flow concept, in which events are triggered by the arrival of data at the processor. Every processing node has, in effect, an in-basket and knows what to do with data that appears in the in-basket.

Applied to IS architectures, this would result in systems in which each processing node works locally, based on its input and without making assumptions about the state of the other nodes in the total system beyond what is communicated directly by the data in its in-basket. In this way the enterprise-wide system is built through the interaction of a multiplicity of independently acting agents.

A third promising direction is to be found in the examination of the overall flow of information through the enterprise, and a fourth in the recognition that the real output of the information system is not information, but action.

By establishing and accepting the three criteria presented earlier, we can at least begin to find ways to develop effective IS architectures. Thus, we can avoid the throw-the-baby-out-with-the-bathwater options that simplistic adherence to one criterion at the expense of the others leads us to embrace all too easily.



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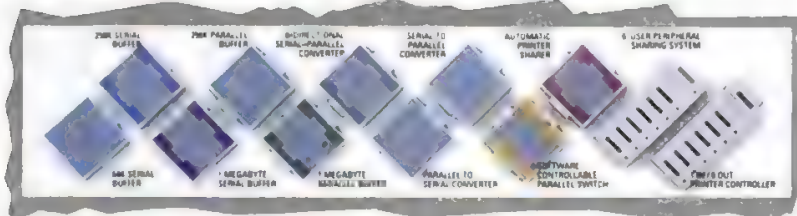
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MS Works	92
PFS First Choice	94
SmartWare II w/Spell Chkr	429

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Adobe Illustrator/Windows	\$269
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Finesse	84
Harvard Graphics Draw Partner	85
Newsmaster II	43
NewsRoom Pro	24
Pagemaker 3.0	489
PC Paintbrush IV Plus	105
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PrintShop (NEW)	35
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Publishers Paintbrush	152
Ventura Publishing	509
Ventura Publishing Pro	345
Word Perfect 5.1	245

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Avery Lable Pro	\$44
Avery List & Mail	28
Avery List & Mail Plus	38
1 DIR Plus	45
386 To The Max	42
386 To The Max Professional	72
Above Disk	55
Auto Menu	35
Back It 3.1	55
Battery Watch Rel. II	27
Brooklyn Bridge	75
Carousel 3.0	47
Check It 2.2	79
Copy II PC	22
Copy II Option Board 5.2	103
Corefast 2.0	57
Desklink	96
Desqview	69
Desqview 386	116
Direct Access	47
Disk Optimizer 4.0	37
Disk Technician Advanced	89
Disk Technician Prof	36
Fastback Plus	98
Form Filler	78
Formtool	49
Formworks w/Fill & File	81
Go Script	115
Go Script Plus	245
Headroom	68
Hyper Pad	62
Laplank III	85
Lotus Agenda	249
Lotus Magellan	98
Mace Gold	80
Mace Utilities	53
Mace Vaccine	53
Memory Mate	38
MS Windows 286	61
MS Windows 386	120
Move 'Em	43
Norton Commander 3.0	79
Norton Advanced	79
Norton Editor	40
Norton Utilities 4.5	53
Optune	43
P.C. Fullback Plus	47
PC Quick Power Pack	69
PC Tool Deluxe 5.5	70
Print Q	71
Q DOS II	34
Qemm 386	53
Sidekick Plus	129
Sideways	37
Software Bridge	72
SPF/PC	143
Spinwrite II	67
SQZ Plus	59
Super PC Quick	69
Twist & Shout	47
VGA Dimmer	19
Windows Color	25
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XTree	24
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Total Word	285
Volkswriter 4	99
Volkswriter Deluxe Plus	79
Word (Microsoft)	205
Word Perfect 5.1	245
Word Perfect Executive	129
Word Perfect Library	69
Word Perfect Office	79
Wordstar 2000 Plus 3.0	259
XY Write III +	92

LAN & NETWORKING

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Dbase IV Lan	599
Foxbase LAN	285
MS Excel/Network Node	152
MSWord Network Node	119
Paradox Network	627
PFS Professional LAN	277
Q & A Network Pac (3 User)	252
R Base for DOS 1-6 Network	617
Supercalc 5 LAN (req. Supercalc 5)	295
Ventura Publishing Networking	759
Word Perfect Additional User	155
XTree Networking (Novell)	209

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3 1/2 DS/DD (100)	\$95
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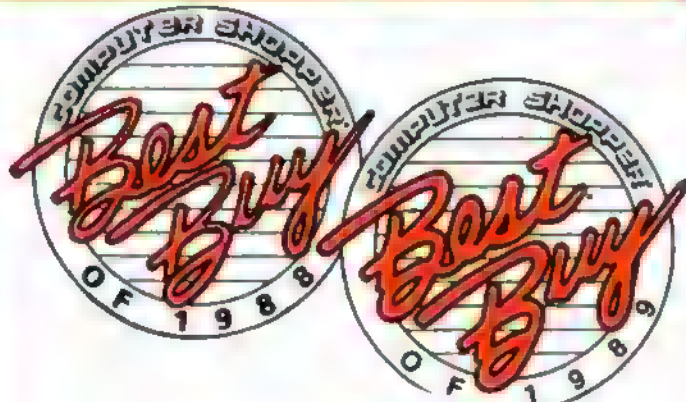
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Allegro 24-Pin	\$315	Desk Jet Plus	735
Other Models	Call	Laser Jet II	1785
Citizen Printer		Laser Jet 2P	1069
120D	139	Other Models	Call
180D	155	NEC	
GSX 140	315	P2200XE	315
HSP 500	319	P5200	505
Other Models	Call	P5300	675
Diconix		890 Silent Writer	3149
150	Call	Okidata	
150 Plus	335	182 Turbo	229
Epson		320	315
FX850	365	321	469
FX 1050	485	390	469
LQ510	345	391	635
LQ850	535	393	999
LQ950	534	Other Models	Call
LQ1050	729	Panasonic	
LX810	195	1124	290
Other Models	Call	1180	179

COMPUTERS

ALR	
Power Flex 288/40MG	\$1205
AST	
Models	Call
Everex	
Other Models	Call
Mitsubishi	
Laptop 20 MB	Call
Other Models	Call
Packard Bell	
Other Models	Call
Toshiba	
T-1000 w 512K	670
T-1600/20 Meg HD	3349
T-1600/40 Meg HD	3739
Zenith	
Minisport Model 1	1449
Supersport 2	1849

PLOTTERS

Houston Instruments	
DMP52	\$2289
DMP61	2779

ACCESSORIES

Computer Tool Kit	\$19
Disk Bank w/Lock 35 + 5.25	12
Keyboard Drawer	35
Curtis	
Clip	5
Keyboard Saver	25
Monitor Arm Standard	39

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Other Models	Call
ATI	
EGA Wonder Enhanced	105
VGA Wonder 256K	345
VGA Wonder 512K	405
Super VGA 256K	Call
Other Models	Call

Marculan	
Color Card	100
Graphics Cards Plus	175
Other Models	Call

Intel	
80287-6	119
80287-8	185
80287-10	209
80387-16	319
80387-20	365
80387-25	459
80387-33	559
8087-1	150
8087-2	115
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Other Models	Call

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Tiny Turbo 286	205
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Autoswitch 480	79
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VGA + 16	185
VGA Professional	229

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Fastwrite VGA	219
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Other Models	355

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Netware	Call
Passive Hub	Call
SMS MDL 130 Arcnet Card	112

Terra	
Lancard	80
Ethernet	235
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50	369
60	289
85	359
150	275

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9600	405
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Logitech	
Scanman + XT/AT	163

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Diamond Scan 16"	1139
VGA 1429C	389
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Multisync GS-2A	210
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PC Magazine - September 12, 1989

"Here's Proof It Can Be Done Right!"

PC Magazine - September 12, 1989



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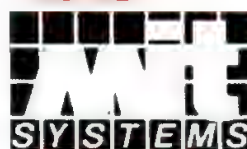
MIT 386-20 **\$1188⁰⁰**

MIT 386SX-16 **\$975⁰⁰**

MIT 386-25 **\$1843⁰⁰**

MIT 386-33 **\$2789⁰⁰**

Standard Features	XT-10	286-12	386SX-16	386-20	386-25
CPU	8088	80286-12	386SX-16	80386-20	80386-25
Speed (MHz)	10/4.77	12/6	16/6	20/8/6	25/8/6
Bios	ERSO	Phoenix	AMI	Phoenix	Phoenix
Norton SI Rating	2.1	13.4	19.01	23.0	30.5
Wait State	0	0	0	0	0
Standard Memory	640K	1 MB	1 MB	1 MB	1 MB
Shadow Memory	-	-	-	64 K	64 K
Cache Memory	-	-	-	32 K	32K
Co-Processor Slot	Yes	Yes	Yes	Yes	Yes
Expansion Slots (8 bit)	8	2	2	2	2
Expansion Slots (16 bit)	-	6	6	5	5
Expansion Slot (32 bit)	-	-	-	1	1
FD/HD Controller	W/HD	Yes	Yes	Yes	Yes
Device Bays	4	3	3	5	5
Serial Ports	-	2	2	2	2
Parallel Ports	-	1	1	1	1
Game Port	-	1	1	1	1
Clock/Calendar	Yes	Yes	Yes	Yes	Yes
Power Supply	150 W	200 W	200 W	200 W	200 W
Keyboard	101 Key	101 Key	101 Key	101 Key	101 Key
Floppy Drives	1	1	1	1	1



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60MB HD (SCSI/Half Hgt)	568.00
80MB HD (28ms MFM)	614.00
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EGA Video System*	430.00
VGA Video System*	572.00
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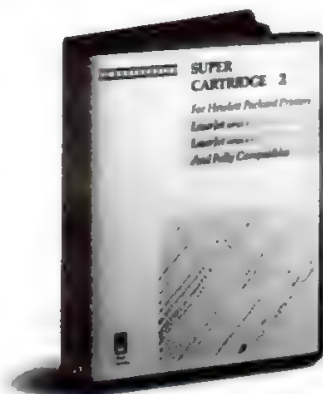
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Stephen Manes



**In the fast-changing
computer industry,
it's not easy to
keep up with the
latest headlines.
Or is it?**

"Megachange! Ultrachange! Superultramegachange!" The words were clanging in my throbbing head the morning after a gathering that boasted a particularly well-stocked open bar. The throbbing got worse when my friend Wannabee Tycoon burst onto the scene.

"Extra! Extra! Read all about it!" He was waving a copy of one of those computer-industry tabloids that the publisher will send you free for the asking until doomsday, provided your subscription application portrays you as a person whose purchasing influence will cause potential advertisers to salivate uncontrollably. Tycoon likes to bring this rag over now and then just to rub in the fact that he gets it weekly without fail, whereas all I get is occasional long-distance sarcasm from the circulation department.

The other reason he brought this issue along was as recompense for swiping a copy of its competitor from me when it misspelled his name three times. The competitor considers me a fine fellow, but apparently failed to believe Tycoon's claim to being President, Chief Executive Officer, Majority Stockholder, and Purchasing Director of a small, unknown firm that somehow was using approximately 10 percent of the mainframe, mini, microcomputer, and cash register output of the free world since the dawn of time.

"Check this out," Tycoon ordered, pointing to a headline. "'Windows-Related Products Will Be Showcased at Forum.'"

"Some news!" I snorted. "I seem to remember reading that in the issue of mine you snatched."

"Well, only so much happens in any given week. But the mag you get didn't cover this."

I followed his pudgy finger across the page. "IBM Widens the Role of Minis to Serve as Mainframe-PC Link."

"Hot stuff," I muttered sarcastically.

"You're too blasé," Tycoon said. "No wonder they won't send you this thing."

I scanned the rest of the headlines. "'NEC to Debut Fast Lap-Top For Under \$2,000 by End of Year.'" I read. "So?"

"Front page news, pal. Along with 'AT&T Execs Plan Radical Overhaul of Computer Effort.'"

I yawned. Tycoon flipped to the middle of the magazine. "Look here: a full-color picture of Jon Shirley and Bill Gates—you know, Shirley's retiring from the company in a couple of months."

I just grunted. Then I noticed what passed for a scoop. "'Is IBM-Microsoft Relationship Near Its End?' Let me guess: lots of maybes, no firm conclusions."

EXPERTS AGREE

"You got it," said Tycoon. "Skip that one. How about this: 'Experts Agree: Standard Needed For Printer Driver.'"

"Experts agree?" I snorted. "Everybody agrees!"

"'PC Graphics a Big Hit for Business Presentations.'"

"Not with me."

"'Rapid Growth Is Forecast for Expert Systems.'"

"Sure. The forecast was probably gener-



ILLUSTRATION: JEAN-FRANÇOIS ALLAUX

ated by one of those expert systems."

"'Buyers Are Getting More Lap-Top Alternatives.'"

I grabbed the magazine from his hands and attacked it with a pair of scissors.

"What are you doing?"

"Sending it in to 'Abort, Retry, Fail.'"

"Don't deface this valuable issue!" Tycoon shouted indignantly. "Hey, I've got a complete run of these going back five weeks!"

Stephen Manes

I put down the scissors and scanned the "News of the Week": "Javelin Hopes Discount Will Win Users."

"Javelin?" I exclaimed. "There's a blast from the past. Remember when they were going to knock off Lotus?"

Tycoon winced and nodded. "One of my less prudent investments."

"General-Purpose Laser Printer Coming from Epson for \$2,400," read the headline below the Javelin piece. That somehow sounded a little high—about a thousand dollars too high. But as I began to read the story, Tycoon turned the page.

The next spread had a big ad for a Xerox color printer that I thought had been discontinued. Facing it was the headline "Apple Announces Major Gains for Fiscal Year 1986."

"1986?" I wondered, and flipped to the front page. 1986, all right: October 21, to be exact. Three and a half years ago.

"Gotcha!" Tycoon was wearing a wide-carriage grin at the success of his little prank.

"It's this hangover," I said, trying to save face. "Slows down my reaction time."

"I'll say. Pretty amazing, though, you've got to admit, considering all those friends of yours at the party going on about ultrachange and megachange. Take a look through this thing. Pretty interesting, huh?"

I paged through the ads and the editorial copy. "What do you mean, no change?" I demanded. "Back then, there was no PS/2. No Micro Channel. No VGA, OS/2, or 486. No NeXT or OSF. Laser printers just taking off. Hardly any scanners."

"I didn't say *no* change. But as far as users are concerned, everything you've mentioned so far is relatively trivial. Take a look at networks."

That wasn't easy. You could find network products in the ads, but you definitely had to hunt for them.

"So I give you that one," he said. "That's a substantial change, though hardly mega or ultra. But what else?"

An ad for Michael Dell's PC's Limited quoted a trade-publication review: "I was never aware of waiting for the computer to catch up with me. Even over-stuffed programs like *Microsoft Windows* and *Word* become limber at 12 MHz.

Running at 12 MHz, the 286-12 seemed so natural as to be invisible." I read. "Reckon this here 386 of Intel's will still be necessary, pardner?"

"Hype never changes," Tycoon assured me.

"\$2,695 for this 'invisible' 12-MHz 80286—box only, 1MB of memory, no monitor or video. Prices certainly have dropped."

"For hardware. Check out the software ads."

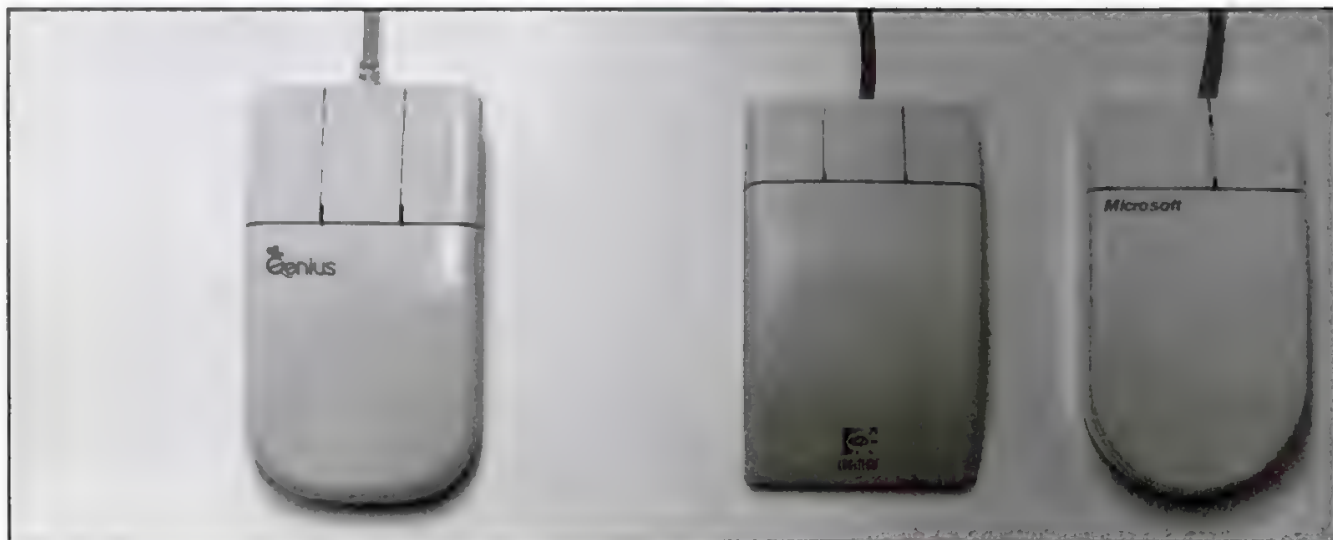
I did. Far fewer products than today, yet generally lower prices. "Not exactly what you'd expect from a competitive market," I muttered.

"What competitive market?" Tycoon growled. "You want 1-2-3, buy 1-2-3. You want *Excel*, buy *Excel*. They might as well be in different product categories. There are no real clones, except in the *dBASE* world. And thus no true competition. Now: Did you notice the one really important change?"

I shook my head. "Must be this hangover. What?"

Tycoon gave me a triumphant look. "This: Back then, nobody went around overselling change." ■

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Above are the three best selling mice in the world. And no wonder. Each of these manufacturers is dedicated to uncompromised quality, state of the art technology, and ergonomic design. However, as you can see, one stands apart, even among these over-achievers. The Genius Mouse GM-F301

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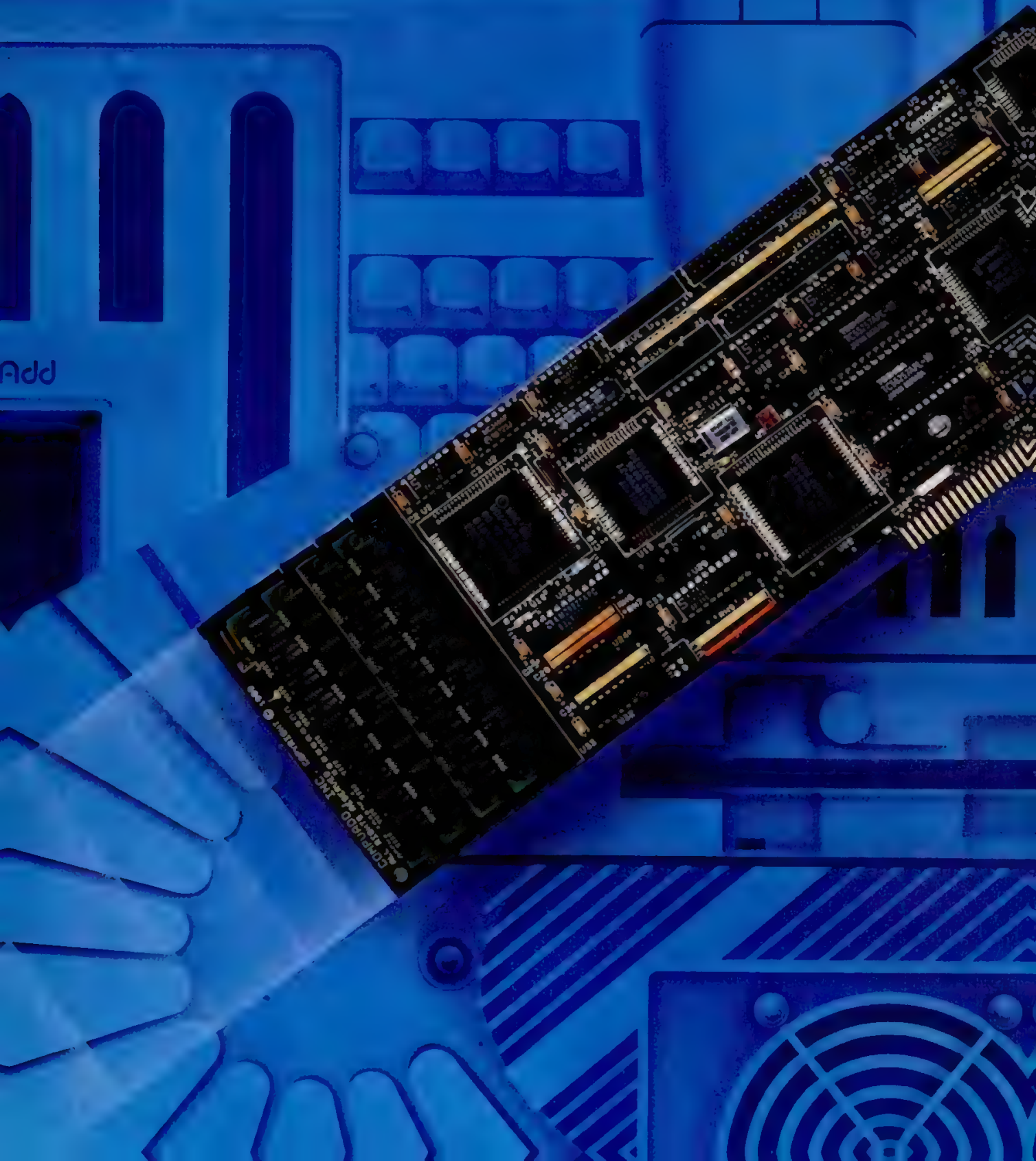


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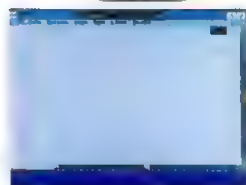
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At 0:00:12

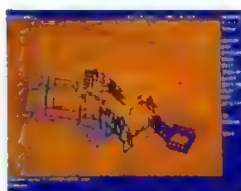


At 0:02:14



With HardCache/ESDI

Screen redraw of a **PageMaker** layout with scanned graphics (764KB file).



Screen redraw of an **AutoCAD** image file (135KB file).



dBASE IV sort-and-write on a 1.8MB file (62-character description field).

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Arts & Letters Graphics Editor 1.02 (Computer Support Corp.)	80	3.0/1.0	87	80	84	79	78	79	76	82	74	78	90	76
Micrografx Designer 2.0 (Micrografx Inc.)	78	6.3/1.0	84	80	80	77	73	78	58	81	74	74	78	77
Kinetic Art 1.203 (Kinetic Presentations Inc.)	76	11.6/2.0	92	83	80	67	76	64	61	78	66	66	74	67
Artline 1.0 (Digital Research Inc.)	72	3.7/1.0	87	77	81	70	71	69	70	74	70	62	63	67
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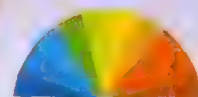
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Drawing/editing (100)	Excellent	Good	Excellent	Satisfactory	Very Good
Documentation (100)	Very Good	Satisfactory	Good	Satisfactory	Good
Ease of learning (100)	Satisfactory	Satisfactory	Good	Satisfactory	Good
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Error handling	Satisfactory	Very Good	Good	Good	Good
Support (50)	Good	Satisfactory	Excellent	Good	Very Good
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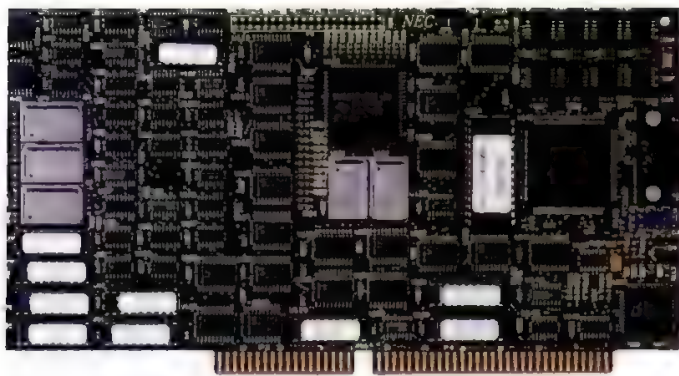


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1024 COLOR

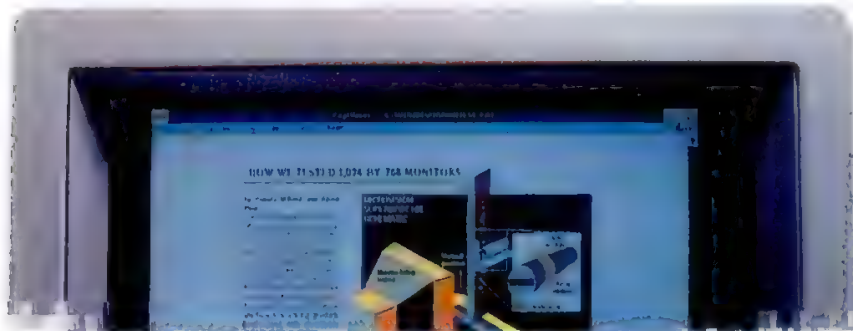


Combine a 1,024-by-768 noninterlaced color monitor with a graphics adapter and you've got both halves of the high-resolution display system of choice for desktop publishing and CAD applications.

A thousand points of light is a grand idea, providing you can arrange the dots in a row across the screen of your PC. Add a couple dozen more, duplicate them 768 times, mix in a rainbow of colors, and you have the key to getting razor-sharp CAD renderings and photo-quality graphics: the high-resolution color display system. Today, high-resolution color means images measuring 1,024 pixels horizontally by 768 vertically, monitors with analog inputs capable of handling an unlimited number of colors, and graphics adapters with eight color planes or sometimes more, delivering 256 simultaneous colors from a palette of hundreds of thousands of colors. Once the purview of unlimited capital budgets and Vanderbilt heirs, these high-resolution color systems are now available to most of us.

The reasons for investing in high-resolution color are multiplying, as are the rewards. An ever-broadening range of applications is taking advantage of—even demanding—the sharpest possible color display system.

By **WILL L. RASCH**



PHOTOGRAPHIC: CARL FLATOW

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Besides computer-aided design (CAD) programs, which have always required the highest-resolution display you can afford, desktop publishing packages now are incorporating color abilities. Couple *PageMaker* and a color scanner, for example, and you can blend text and Polaroid-perfect color images into a personally published newsletter that will make even the latest *Vogue* seem drab, lifeless, and a season (or generation) out of date.

Tie a thousand-pixel color display system to your presentation graphics or prototyping software and you can preview your work on-screen with truly life-like quality. A resolution of 1,024 by 768 pixels approaches the quality you get from 35mm slides. And a palette of 262,144 colors (even if you can only put 256 hues on-screen at once) can mimic reality closely enough that you'll have to wipe the smudges from your spectacles to tell the difference.

Open a window in a high-resolution

display and you'll see one reason why graphical operating environments are finally taking off after five years of promises. Sales of all versions of *Microsoft Windows* now top 100,000 per month, and the Presentation Manager's new look is

making OS/2 1.2 increasingly attractive. High resolutions let you clearly see data in multiple windows without straining your eyes—or your aesthetic sensibilities.

But the most important reasons for considering a high-resolution display system now are affordability and availability. Hardly a year ago, multiscanning monitors capable of a thousand lines of noninterlaced color were as rare as restraint in a Trump casino; today, however, nearly every monitor manufacturer offers at least one model.

Prices of high-resolution color monitors and graphics adapters have also plummeted. Where once the prices of high-resolution display systems soared higher in the stratosphere than even Chuck Yeager dared navigate—up to \$4,000—today you can buy a 1,024-by-768 noninterlaced color monitor and a graphics adapter for as little as \$1,700.

In this issue, we examine both of the hardware elements you'll need to buy to

HIGHER RESOLUTION: It's All In The Timing

by Alfred Poor

A high-resolution RGB color monitor is similar to a standard RGB color monitor—and, for that matter, to a color television screen. In all three, the image is made up of tiny red, green, and blue dots that light up in varying degrees of brightness to create the colors of the rainbow.

The major component of any monitor is the vacuum tube, which contains the other elements. The electron guns emit streams of electrons that form three beams, which are in turn aimed by a magnetic deflection coil. The phosphors are small dots of chemicals that glow with distinctive colors when hit by electrons. A shadow mask screens out portions of the beams so that each hits only its correct color phosphor. For almost every monitor—including high-resolution ones—the entire pic-

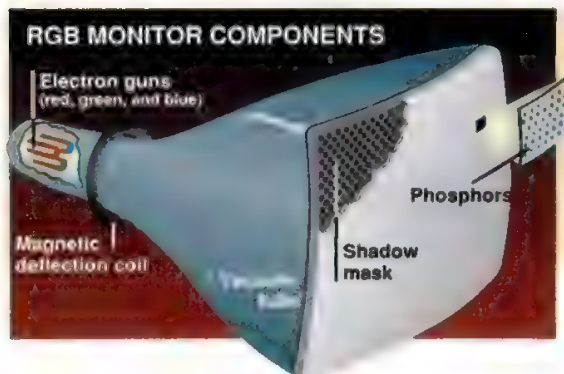
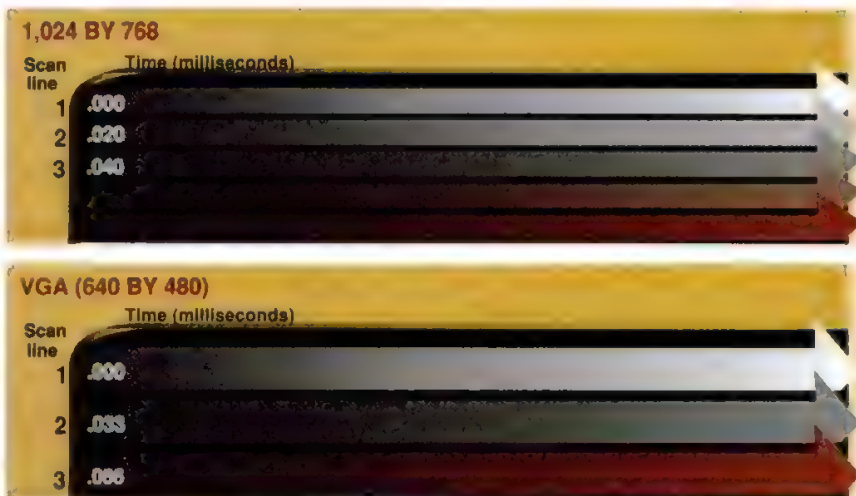
ture is repainted 60 times every second.

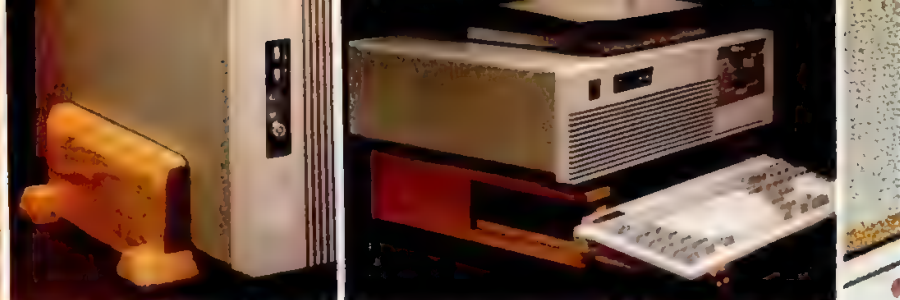
The biggest difference between high-resolution and other monitors is that the beams in high-res machines must play across the screen much faster than those in a VGA display or color television. Since there are almost twice as many lines in a 1,024-by-768 display as in a 640-by-480 (VGA) image, the beams must move nearly twice as fast.

If you were to start timing a 1,024-by-768 display at the instant the first line began to appear, you would find that the second line is begun about .02 milli-

seconds later, and the third line .04 ms. after the start. In a VGA image, the second line is not begun for .033 ms., and the third .066 ms. after the start. A similar speedup is required along each line, since the high-resolution image requires that almost twice as many pixels be drawn per line.

Thus the difference between these high-resolution monitors and other color CRTs is in their performance. To achieve that performance, the high-resolution machines require components capable of performing at substantially higher rates, allowing for the fine detail created by drawing nearly 800,000 pixels 60 times a second.





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1024 DISPLAY SYSTEMS

put together a high-resolution color display system. First we'll look at the visible half of the pairing, surveying color monitors capable of displaying at least 1,024-by-768 noninterlaced images. Then we'll consider the graphics adapters that will link to your applications and produce the signals required to drive those monitors.

SOFT FIRST STEP

One warning before you read any further: Although high-resolution color support is becoming increasingly widespread in software, it is by no means universal. You should not even consider buying a high-resolution color display system unless you

have an application that demands it.

Today, few DOS-based applications benefit from higher resolutions. Only a handful of programs offer built-in support for 1,024-by-768 modes, and these modes may apply only to specific graphics boards. Otherwise, you're dependent on the drivers supplied by the maker of the graphics adapter that you choose. These drivers are usually limited only to graphical operating environments—*Microsoft Windows*, *GEM*, and sometimes the *OS/2 Presentation Manager*—and the most wildly popular programs—*AutoCAD*, *Lotus 1-2-3*, and

WordPerfect. Without one of these software links, your investment in high-resolution color is likely to buy you only a very expensive VGA display—albeit one that may provide a growth path to future high-resolution-oriented applications.

This software-comes-first philosophy reflects the underlying nature of PC graphics. The image that appears on your display is built through the cooperation of your software, graphics adapter, and monitor. The software is the architect and blueprint of what you see. It works out all the details of the display but has no power of its own to make them into reality.

The graphics adapter translates the plan

So you're convinced it's time to leave VGA behind for higher resolutions. Now what? Unfortunately, it's not clear which way to jump. The problem is a lack of standards—or too many standards, depending on your point of view.

In the PC marketplace, video standards have historically been set by IBM, with the notable exception of Hercules monochrome graphics. But when it comes to high resolutions, IBM's interlaced answer to 1,024 by 768 is seriously flawed: some maintain that the flickering on the IBM 8514 screen turns a bottle of aspirin into an important computer peripheral (see the sidebar "8514: The IBM Way").

With IBM offering less than sterling leadership, others have stepped in with competing solutions. At the moment, there are three camps: Extended VGA (as defined by the Video Electronics Standards Association), 8514/A clones, and graphics adapters that are based on the Texas Instruments 34010 graphics coprocessor.

EXTENDING VGA

Extended VGA is just what it sounds like: an extension of the VGA specification. Also called Super VGA (except by those who limit the term to 800 by 600), Extended VGA started out as several idiosyncratic schemes. Each manufacturer devised its own approach and provided its own set of drivers for specific software. In an attempt to bring standards to this free-for-all, a group of manufacturers, led by NEC, formed VESA, the Video Electronics Standards Association, in late 1988. In 1989, VESA published two standards: one for 800-

Searching for Standards

by M. David Stone

by-600 resolution and one for noninterlaced 1,024-by-768.

Unfortunately, there is an important limitation to the Extended VGA route to high resolution. Like all PC video standards before it, Extended VGA makes the computer's CPU do all the work, manipulating graphics in the computer's main memory. At lower resolutions, this hasn't been a serious problem, since there was relatively little work to do. Yet even at these lower resolutions, graphics-intensive programs will speed up noticeably if you add a math coprocessor. And as the resolution and the number of colors increase, the work demanded from the CPU becomes an increasing drain on system performance.

COPROCESSOR ON BOARD

The straightforward answer to this limitation is to put a graphics coprocessor on the graphics adapter. The coprocessor takes work off the CPU, speeding up both graphics and overall system performance. The battle currently shaping up over high-resolution standards is between two variations on this theme: the 8514/A and the Texas Instruments 34010.

The 8514/A clones are not slavish copies of the IBM 8514/A. The interlacing on IBM's 8514/A has to do only with what happens between the video card and the monitor. The 8514/A clones maintain compatibility elsewhere, but they don't require interlacing.

As of this writing, VESA is developing an 8514/A specification, which should be completed at the Spring 1990 Comdex. According to Greg Reznick, vice president of graphics marketing at Headland Technology and chairman of VESA, all but a few low-end 8514/A boards will support a noninterlaced mode. Reznick expects that most boards will be settable for noninterlaced mode either through software configuration or through a jumper or DIP switch setting.

In some ways, the 8514/A and the TI 34010 are similar. Not only do both offload graphics processing from the computer's CPU, but both also offer a software interface to send commands to the graphics board: IBM's Application Interface (AI) for the 8514/A, and Texas Instruments Graphics Architecture (TIGA) for the 34010. There are differences, however.

One difference that TIGA supporters like to point out is that TIGA offers a clear growth path. Once you have a TIGA board and software that supports it, you can move to the next-generation TIGA board without having to upgrade all your software. In fact, TI's second-generation chip—the 34020—is already available, with later generations promised.

Those in the 8514/A camp argue that this is a non-issue because the 8514/A chips that already exist can support 1,280-by-1,024 resolution. Bill Chu, vice president of engineering for graphics at Western Digital, goes even further. He argues that for general-purpose business applications, the very concept of a software interface is flawed pre-

of the software blueprint, organizing its instructions into a memory map of what you'll see on-screen. It also converts its own digital memory codes into a video signal compatible with your monitor. The monitor, in turn, transforms the electrons of the graphics-board signal into the photons that you can see.

From another perspective, the graphics adapter determines how the details of each image will be shown on-screen. The adapter will determine the number of pixels that you'll see, the number of different colors in which the pixels may glow, how fast displays can change, and how much your computer will slow down

when you shift from text mode into graphics gear. The monitor determines the sharpness of the image that you finally see, as well as its size, clarity, and purity of color. The monitor can never display more than the graphics adapter generates, but it can limit how much quality you finally get to see.

PUTTING IT ALL TOGETHER

Compatibility is your major concern in selecting a high-resolution color graphics system. Your purchase decision should be a three-step process:

- **First**, consider your application. Check what graphics adapters it supports and what graphics adapters support it.
- **Then** choose the graphics adapter that offers the resolution, performance, and operating modes that you prefer or need.
- **After** you've found the right graphics adapter, choose a monitor that will handle its output.

You'll be rewarded with results as sharp as David Letterman's tongue and as colorful as Tammy Faye Bakker cut loose in a Revlon factory. If you're serious about graphics, you've got good reason to—and few excuses not to—invest in a thousand-pixel color display system.

cisely because it doesn't specify the hardware. To Chu, the claimed strength of TIGA—portability through software—is actually a weakness. Chu's position is that developers should write to the 8514/A hardware for maximum performance. Not so incidentally, Western Digital makes an 8514/A-compatible chip set and graphics adapter.

Of course, issues of performance make for a potentially telling difference between the 8514/A and TIGA choices. But here again, you can find arguments for both camps. The 8514/A is a kind of idiot savant. What it knows how to do, it does quickly; but there are only a limited number of things it knows how to do. By contrast, the Texas Instruments 34010 is a full-fledged, general-purpose microprocessor that has been optimized for graphics.

What this means for real-world applications depends on whom you talk to. Supporters of TIGA casually refer to the 34010 as the technologically superior solution. And TI claims that the 34010 with TIGA executes *AutoCAD* redraw operations 16 times as fast as than the IBM 8514/A with its AI software. But supporters of 8514 have their own point of view.

Reznick, for example, readily admits that the TI chip is more powerful, in the sense that you could build a computer around it. "But that doesn't mean it's the best graphics accelerator," he says. "What you end up doing on these boards is mostly moving things around and drawing lines, and that's precisely what the 8514 is good at."

Keep in mind also that the performance of any given board depends on

more than just the graphics coprocessor. In particular, performance can depend greatly on the kind of RAM the board uses: conventional dynamic RAM (DRAM) or special-purpose video RAM (VRAM).

Since DRAM offers only one path for memory access, memory has to switch between display refresh and the graphics coprocessor. VRAM offers two paths of access, allowing both functions to take place simultaneously. Using VRAM yields faster performance for the board but also costs more. Some low-end 8514/A clones are keeping their prices down by using DRAM instead.

According to Reznick, the speed difference between Extended VGA and low-end 8514/A clones is minimal. On high-end boards, however, an 8514/A clone can be anywhere from two to ten times as fast as Extended VGA, depending on the application.

With questions of technical superiority still being debated, the winner in this battle is less than clear. As one board manufacturer points out, the 8514/A starts out with an edge just because it has the IBM name on it. Yet the ultimate winner may be determined simply by price. One knowledgeable observer says, "Whoever hits the magic price point first wins. If both hit the point at the same time, then it's not clear who wins."

There are various ideas about where that magic price point is, ranging from about \$1,500 for a monitor plus adapter down to under \$1,000. But wherever it is, both camps are trying hard to get there—and to get there first.

TI, for example, has recently devel-

oped the 34092 support chip for the 34010. According to Carrell Killebrew, graphics hardware engineering manager at TI, the 34092 can eliminate about 20 chips from a TIGA board, and it should bring the street price of a 34010-based board down to about \$600 this year. In addition, Killebrew says that TI is currently developing other support chips for both the 34010 and 34020.

Regardless of which side eventually wins this battle, there's one encouraging conclusion that almost everyone agrees on. If you want high-resolution graphics now and you're willing to pay today's premium prices for it, you won't go far wrong with either standard.

This is not a case of winner takes all. Rather, the losing camp will probably survive as an alternate choice, much like Hercules monochrome graphics standards. And even the loser in this battle will be widely supported. It's certain that neither TI nor IBM will quietly fade away.

At least one person takes issue with this view, however. Western Digital's Chu says that because of what he sees as the flaw in the very concept of a portable software interface, software developers will not be able to offer widespread support for TIGA if it fails to become the clear standard.

For those who want to play it safe but also want high resolution immediately, there's a third choice. As Reznick points out, you can buy a high-resolution monitor and a graphics adapter that follows VESA's Extended VGA specification and wait to see what happens. When the dust settles on the battle, keep the monitor and buy a new card. ■

ADAPTING TO ADAPTERS

Software rises to chief importance when you consider high-resolution color because of the lack of any true standard among thousand-line systems. In fact, at 640 by 480 pixels, VGA is the highest-resolution display system that's solidly established as standard throughout the PC industry.

At the thousand-pixel level, IBM has offered the 8514/A graphics adapter, and

it has such shortcomings that aficionados of fine video avoid it like Saturday morning television (see the sidebar "8514: The IBM Way"). Worst of its weaknesses is interlacing, the weaving of each frame of its image from two separate fields, a process that lowers both operating frequencies and costs. Interlacing works well as an abstract concept, but in real life it can

lead to flickering displays and a dramatic loss of resolution when monitors don't perform optimally.

With guidance from neither above nor Armonk, the makers of high-resolution color display systems have gone in their own directions, devising their own interface schemes and operating parameters.

The divergence begins with graphics adapters. For the design engineers, graphics controller chips, memory arrange-

8514: THE IBM WAY

by Winn L. Rosch

If you want both 1,024-by-768 resolution and IBM's official imprimatur, you have only one choice: the 8514 display system, which is a combination of the 16-inch multiple-fixed-frequency 8514 monitor and the 8514/A graphics adapter. And if you don't have a Micro Channel computer, you're out of luck: the 8514/A adapter works only in MCA systems.

Being able to use the 8514 display system is hardly a reason to chuck your AT-bus computer and raise the MCA banner, however. One look at the 8514 may convince people that IBM is reviving its Charlie Chaplin advertising campaign—the screen flickers as much as a silent film. The 8514 system relies on screen interlacing to avoid the costly high-frequency circuitry required by the high frame rates of 1,000-pixel resolution.

To display 1,024 pixels across each scan line, IBM upped the horizontal scanning frequency from VGA's 31.47 KHz to 35.52 KHz, a simple design choice. The vertical frequency proved more problematic, however. Maintaining the 59.84-Hz frame rate of the VGA system while increasing the on-screen line count to 768 would have required a much wider bandwidth than could be built into an inexpensive display and adapter. On the other hand, lowering frame rates to below 60 Hz increases the likelihood that the screen will flicker. To keep the frame rate down while avoiding flicker, IBM chose to interlace the image.

An interlaced display scans down the face of the tube twice for each image frame it displays. Each time it scans down, it traces out every other scan line.

On the first pass, it illuminates the odd-numbered scan lines; on the second pass, the even-numbered lines. Interlacing allowed IBM to reduce the 8514 frame rate to 43.48 Hz. However, because each frame is scanned in two successive fields, the refresh rate appears to be twice the frame rate: 86.96 Hz, fast enough to avoid image flicker.

But interlaced images may still flicker; the perception of flicker is quite subjective, varying among individuals and with different ambient-lighting conditions. The effect is most noticeable when the screen is viewed closely. To eliminate the last trace of flicker, manufacturers often use medium- or long-persistence phosphors. IBM chose medium-persistence phosphors for its 8514 display.

Interlacing puts no particular burden on monitors and requires no extra circuitry. To make an interlaced image, a graphics adapter needs only to double its vertical frequency and offset all the lines of the second field by half a line. That offset effectively starts each line of the second field halfway between the lines of the first field, providing the interlace.

One problem multiscanning monitors may have with the 8514 standard is inadequate vertical frequency range. The field rate of an interlaced display is its effective vertical frequency; in the case of 8514, that's 86.96 Hz, which may be higher than monitors designed for non-interlaced 1,024-by-768 images can handle. Check the features table to see which monitors in this roundup support 8514 mode.

Note, too, that the VGA standard is part of IBM's 8514 specification. To be compatible with any true 8514 system, a monitor must also be capable of displaying 640-by-480 VGA images. If a 1,024-by-768 monitor refuses to stoop

so low, it won't be 8514-compatible.

With the exception of its higher vertical frequency, the 8514 standard's requirements are modest enough that many (if not most) multiscanning monitors can handle its signals. Because achieving 8514 compatibility means hardly more than adding an extra line to the specification sheet of a multiscanning monitor, 8514 compatibility is almost independent of market demand and is widely available.

The board side of compatibility is quite different. Compatibility with the IBM's 8514/A board must be specifically designed into graphics adapters, a choice that can be costly. Two levels of 8514/A compatibility are recognized: software compatibility—the ability to use the IBM Application Interface—and hardware compatibility, which means an exact, register-by-register duplication of the functions of the 8514/A board.

Software compatibility is relatively simple to achieve. All AI functions are documented by IBM and can be duplicated by programming a graphics coprocessor. Hardware compatibility is much more difficult to achieve because IBM has not published the register specification of the 8514/A board. The intention was to force programmers to use the hardware-independent AI rather than directly accessing hardware features. Consequently, the only way to achieve 8514/A hardware compatibility is through costly reverse engineering. But through the Video Electronics Standards Association (VESA), graphics adapter vendors have gotten together to standardize on hardware compatibility. By Spring Comdex, VESA expects to publish an 8514/A standard, and several noninterlaced 8514/A-compatible graphics adapters should be available (see the sidebar "Searching for Standards"). ■

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ments, and operating frequencies are all clay to be sculpted into a final product. Owing allegiance to no standard, designers have created the product they think is best, optimizing it for the features they think important. As a result, nearly every high-resolution graphics adapter is so different from the others that it requires its own special form of control. Compatibility with software is hard-won through drivers that match specific programs and environments to a given adapter.

Some software standards have begun to emerge recently. Among them are two published by the Video Electronics Standards Association (VESA), one for 800-by-600 and one for 1,024-by-768 resolution. One hope for bringing order at the software juncture lies in the potential acceptance of a standard higher-level interface—essentially a common language for communicating with graphics adapters. Two such interfaces have gained some degree of acceptance: IBM's Application Interface and the Texas Instruments Graphics Architecture (see the sidebar "Searching for Standards").

MATCHING MONITORS

Putting together a high-resolution graphics display system also requires matching the graphics adapter to a monitor. Fortunately, the need for standardization at this connection has been minimized by multi-scanning technology.

All of the high-resolution monitors examined in this issue are multiscanning: they can lock in on a variety of horizontal and vertical scanning frequencies. In general, a wider range is better, but more important is matching the range of a monitor to the signals produced by the graphics adapter you choose. Turn to the features table in the monitors story to discover which graphics adapters are supported by each monitor. Note that in particular, some monitors cannot work with IBM's 8514/A graphics adapter because it requires a vertical synchronizing frequency that falls outside of their synchronizing ranges.

Another monitor-connection issue concerns the types of signals used. All of these monitors use analog inputs, the de rigueur connection for wide-spectrum color display systems. While digital interfaces artificially limit the range of colors displayable on monitor screens, analog signals impose no such limits. However, IBM's monochrome, CGA, and EGA video standards require monitors capable

of handling digital signals. Only a few high-resolution monitors design to stoop so low, so few are compatible with pre-VGA video standards. Although they will work with low-resolution VGA software modes that emulate lower-resolution video standards, these monitors can't be indiscriminately plugged into any video board.

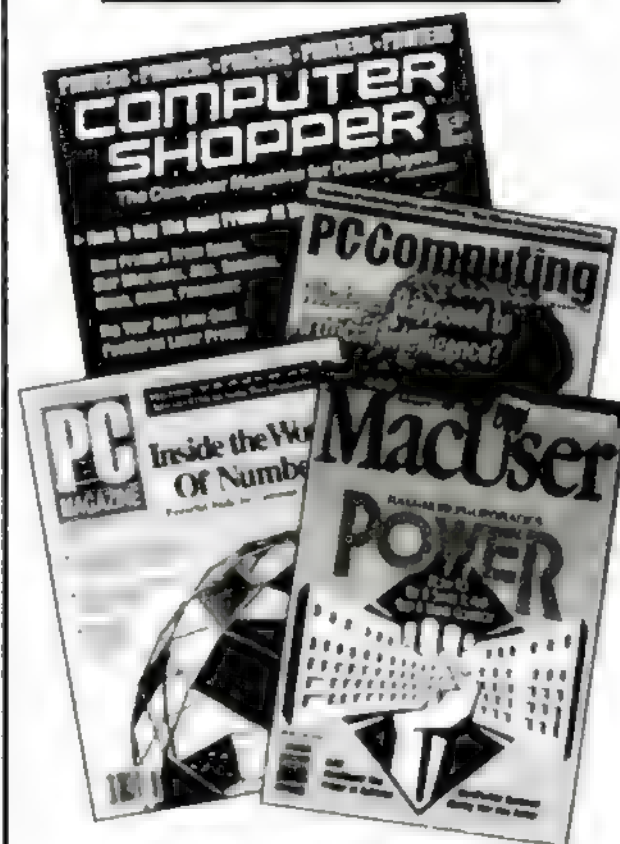
Another consideration in matching a monitor to a graphics adapter is the way synchronizing signals are delivered to the monitor. There are three primary synchronizing alternatives: separate sync, composite sync, and sync on green. *Separate sync* means that the horizontal and vertical synchronizing signals are provided through separate connections. *Composite sync* puts the two signals on one wire and lets the monitor sort them. (Note that composite sync is entirely different from the composite video signal used by inexpensive monitors, VCRs, and other video equipment.) *Sync on green* combines the composite sync signal with the green image signal, allowing one wire to perform three separate functions.

As you'll see from the features table, all the monitors in this roundup support all three synchronizing signals. But not all connectors support all the signals. Our reviews will tell you which connectors on the monitors support the different synchronizing signals.

Your final concern in matching monitor to graphics adapter is the physical connection: linking the monitor's connector and the cable from the graphics adapter. There's no single standard used for high-resolution-monitor input connectors. You'll find that 9- and 15-pin D-shell connectors are popular, as are three or more BNC connectors (for composite sync systems; five are used for separate sync). Again, check the features table.

Match the cable to monitor and graphics adapter, and you're ready to delight your eyes with more and sharper colors than George Bush's best dreams: nearly a million points of light to brighten your way through the toughest CAD assignments, the gutsiest newsletters, the most persuasive presentations. With the right high-resolution color display system, those pretty pixels have never been more affordable, nor more useful. And the thousand points of light you lay across each line of your screen will probably make you happier than can any clever catchphrase or prodigal political promise. ■

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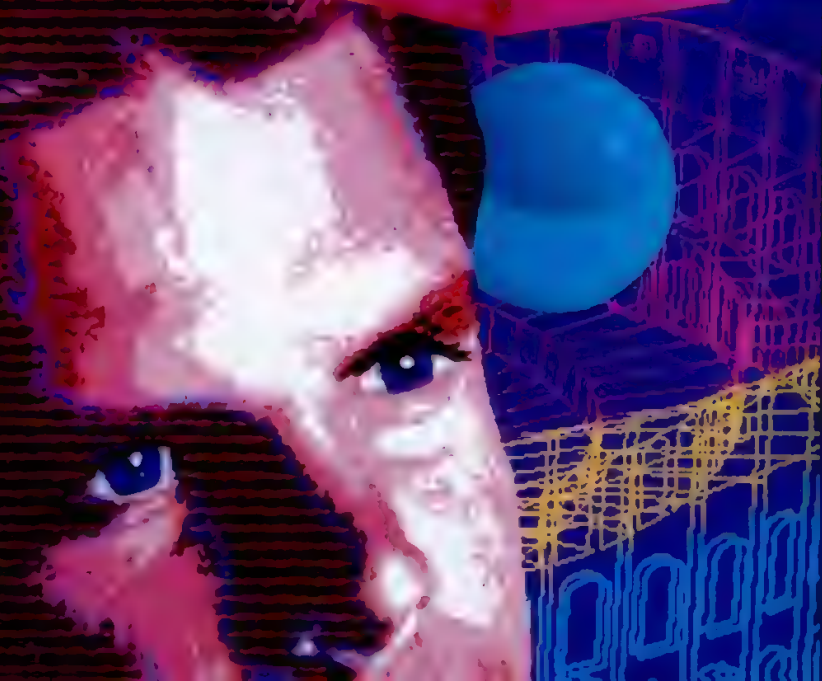
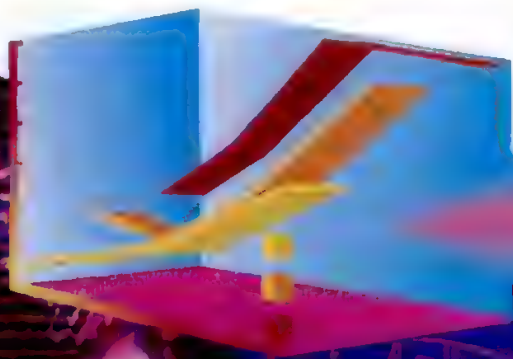
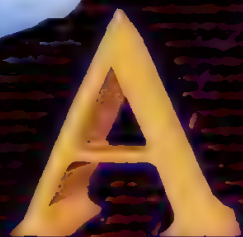
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CIRCLE 368 ON READER SERVICE CARD

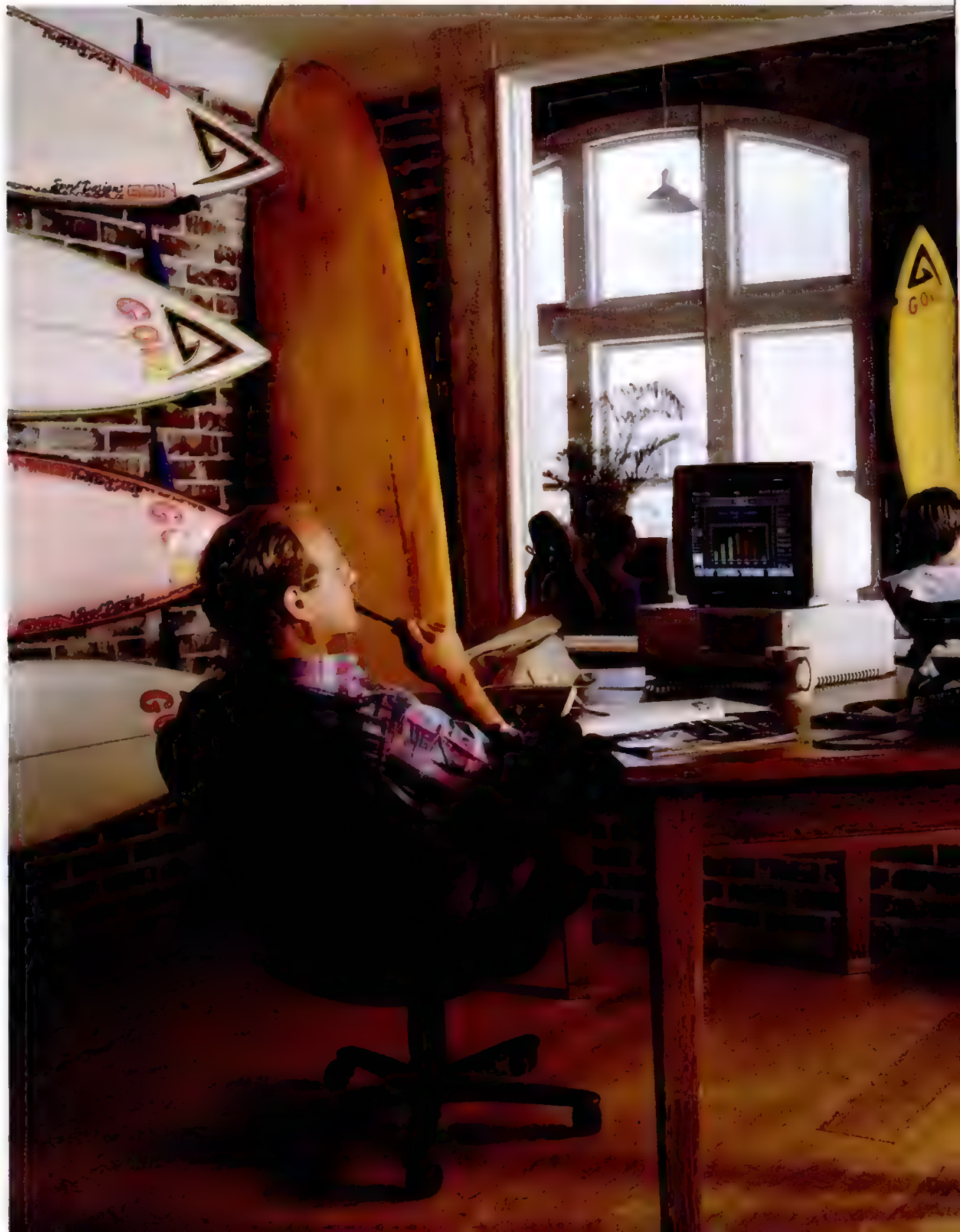
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“Man’s greatness
lies in the power
of thought.”

Pincol



Robert was sold on Hewlett-Packard PCs while

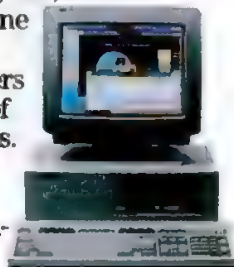


he was still in college.



He was studying engineering and contends an HP calculator was the secret to his success. Since then, HP LaserJet printers have been a big help to his growing company. So when he found he could get Hewlett-Packard reliability in a network of personal computers, Robert decided to stay with a sure thing.

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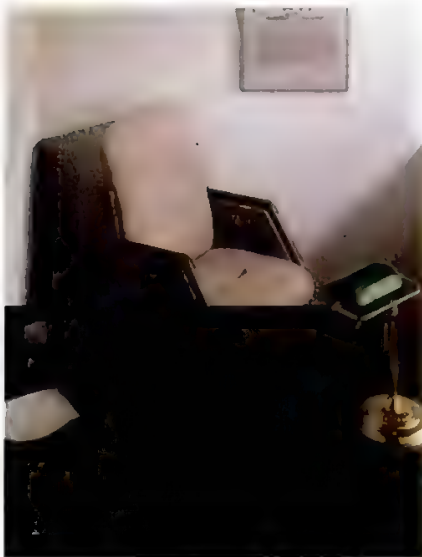


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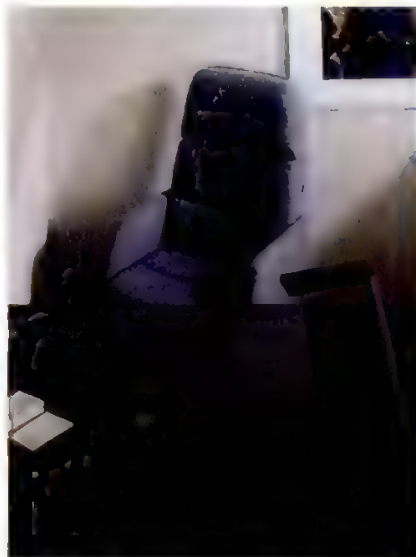
CIRCLE 372 ON READER SERVICE CARD

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We'd like you to meet some of the busiest computer sales reps around.



Steve Nilles, Chicago, IL
(not pictured)



Bill LaVorgna, Wayne, NJ
(not pictured)



Randy Fryer, Baltimore, MD
(not pictured)

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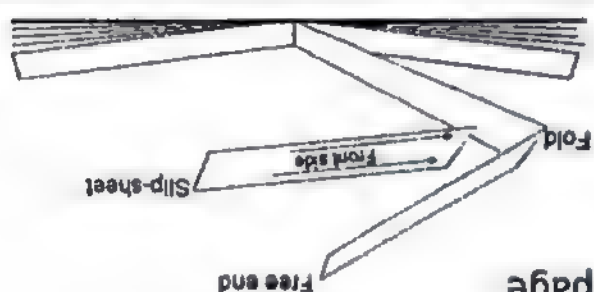
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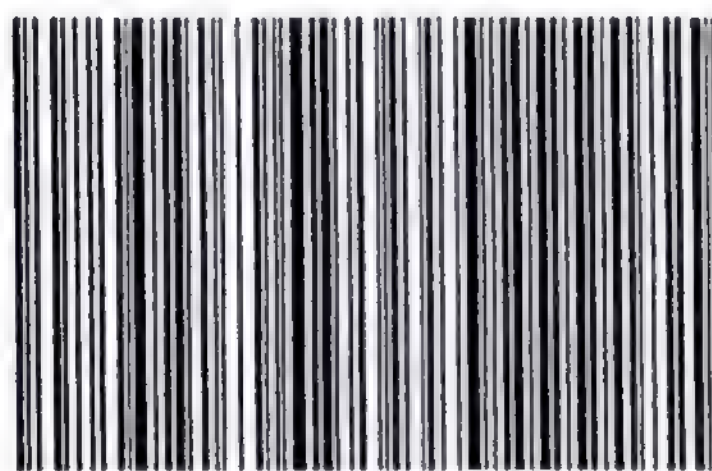
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4. Close the page and slip-sheet



Inverted Foldout slip-sheet



GbsSlipSheet-001



Foldout slip-sheet

Folded edge of the page

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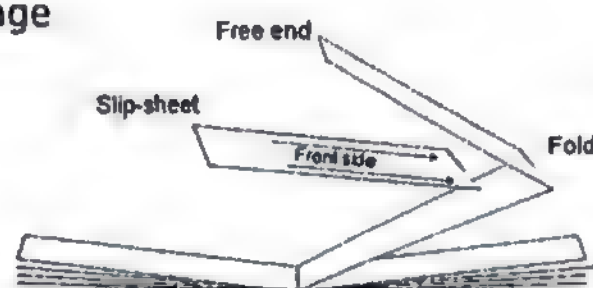
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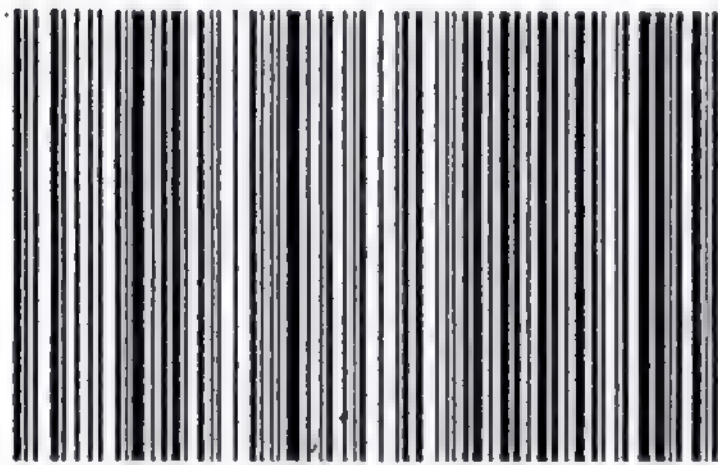
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Inverted Back



Gbs5llpBack-0018

Back

1. Follow instructions on the other side



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Of course a good source of information about any company is its customers. Here's a small sampling of what **Gateway 2000** customers have to tell you:

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DELL COMPUTER CORP.

Graphics
Performance
Display 16C

by Alfred Poor

When you think of Dell Computer Corp., you probably think of the mail-order company that made it to the big time. You probably don't think of high-resolution displays. But if you are in the market for a 16-inch, 1,024-by-768 color display, then you might want to think about the Graphics Performance Display 16C. Its list price of \$1,399 is one of the lowest you will find in its class.

But the low price isn't attached to a stripped monitor. The unit comes with a full complement of features, some of which may not be unique but are certainly uncommon among its peers.

For example, the front panel of the tilt-swivel case offers nine different controls. Besides the power, contrast, brightness, and picture size and location controls, there is also a text-color switch. In addition, you will find a source-selection switch that permits you to hook the monitor up to two different adapter cards or computers and then switch between the signals at the monitor.



Graphics Performance Display 16C

Dell Computer Corp., 9505 Arboretum Blvd., Austin, TX 78759-7299; (800) 426-5150, (512) 338-4400.

List Price: \$1,199 (cable included).

Requires: EGA, VGA, Super VGA, 8514/A, or 1,024-x-768 graphics adapter.

Diagonal Screen Size: 15 in.

In Short: The Graphics Performance Display 16C is an attractive 1,024-by-768 color monitor with an equally attractive price. It can handle a variety of digital and analog video signals, and it comes with a full complement of controls conveniently located on the front panel.

CIRCLE 413 ON READER SERVICE CARD

1,024-BY-768 COLOR NONINTERLACED MONITORS:
PERFORMANCE TESTS

If you're in the market for a 1,024-by-768 color noninterlaced monitor, you'll find that features will affect your buying decision more than performance. On PC Labs' performance tests, there were no clear winners or losers, but all the 1,024-by-768 color noninterlaced monitors performed within an acceptable range. Test results are also in mils*.

For the **Drift** test, the Superspot 100 measures the time variance of an image—how much a line moves over time. In our tests, the results show how much the line moves over 1 minute, averaged for a 2.5-minute test.

The **Horizontal Line Width** test measures the width of a line beginning 1 inch from the left edge of the top horizontal line. Using our *Microsoft Windows* test-pattern image, we measured the widths of red, green, and blue lines, then averaged the results.

The **Vertical Line Width** test measures the width of a line beginning 1 inch up from the bottom of the right vertical line. Using our

Windows test-pattern image, we measured the widths of red, green, and blue lines, then averaged the results.

The **Horizontal Pincushioning** test measures how curved an image is at the edges of the display. Pincushioning is reported in terms of the maximum error from a straight line. The Horizontal Pincushioning test was based on 21 sample points beginning at the right edge and ending 1 inch from the left corner, horizontally.

The **Vertical Pincushioning** test measures pincushioning on a vertical plane, based on 21 sample points on the top edge, starting and ending 1 inch from the corner, vertically.

* A unit of length equal to 1/1000 inch.

CONTINUES

In the back, you will find another surprise. There is a D connector, and next to it is a switch labeled "Analog/TTL." The 16C can accept either analog or digital signals, which means you can use it with a wider range of adapters, including a standard EGA card. There is also a switch that optimizes performance when the monitor is used with just a VGA adapter. The 16C can accept separate BNC coaxial adapter cables, with provisions for all three ways of sending the horizontal and vertical sync signals.

The picture on the Dell was very good, but if it should drift away from the factory settings, you have access to controls that could help. There are three adjustments on the back panel: focus, pincushioning, and convergence. The second and third affect only the horizontal settings, but it is better to have some control over these than none at all.

The manual that comes with the unit is a bit thin but it conveys the necessary information clearly. The 16C also comes with a video cable, which is an advantage over some competitors. The warranty is a fairly typical one-year parts-and-labor guarantee, with Dell paying the shipping one way, but there are some positive twists. First, the manual states that the warranty covers damage that might occur in ship-

ping. Dell also has a 30-day money-back guarantee if you're not satisfied. And to top it all off, should you buy the monitor as part of a total Dell computer system, it will be covered by a one-year on-site service policy.

The 16C produced good to acceptable results on the PC Labs performance tests, often bettering its sibling, the 19C. There are bigger monitors, and there are monitors with higher resolutions, but Dell's Graphics Performance Display 16C offers a competitive, attractive value for anyone seeking a flexible 1,024 color display.

DELL COMPUTER CORP.

Graphics
Performance
Display 19C

by M. David Stone

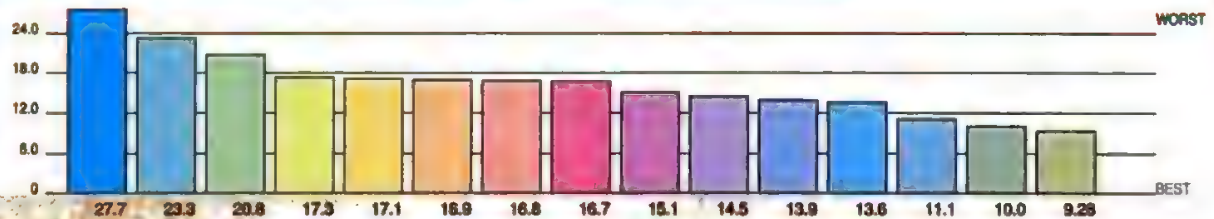
At first glance, the \$2,499 Graphics Performance Display 19C, from Dell Computer Corp., looks identical to Mitsubishi's \$3,790 HL-6915SBK. And indeed, the two monitors have much in common. Like the Mitsubishi, the Dell sports a 20-inch screen with a 19-inch image, and it of-



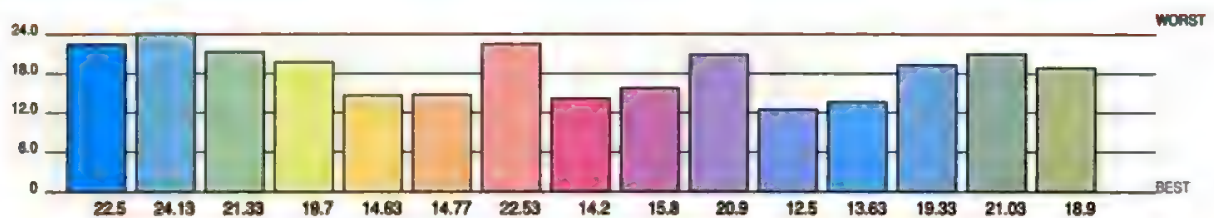
1,024-BY-768 COLOR NONINTERLACED MONITORS: PERFORMANCE TESTS

VGA-MODE RESULTS

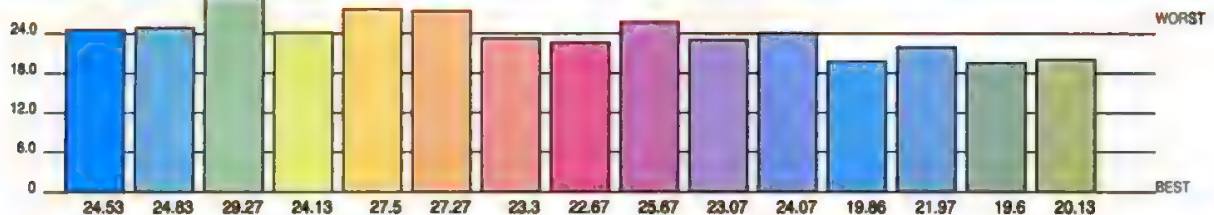
Drift



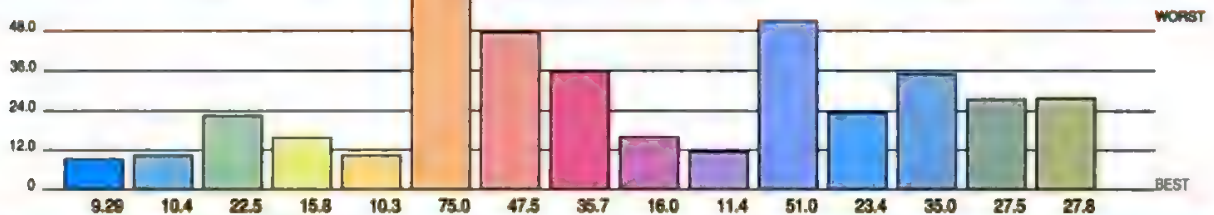
Horizontal Line Width



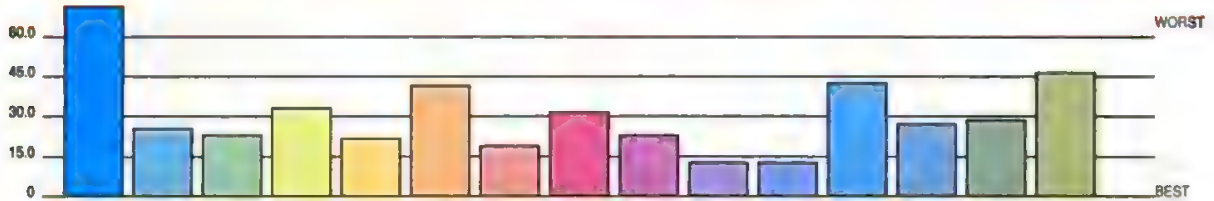
Vertical Line Width



Horizontal Pincushioning



Vertical Pincushioning



Intercolor VS-50
 Graphics Performance Display 16C
 MultiFlat Plus 5121
 Multiscan HQ
 Nanao 9400
 NEC MultiSync 5D
 Accuvue 20-AS
 JVC GD-H6120VFW
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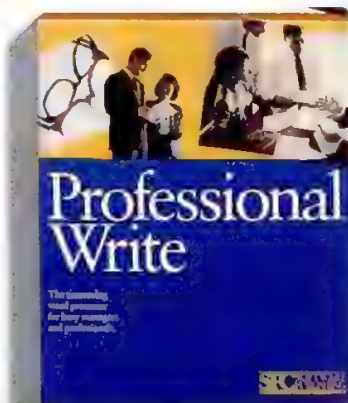
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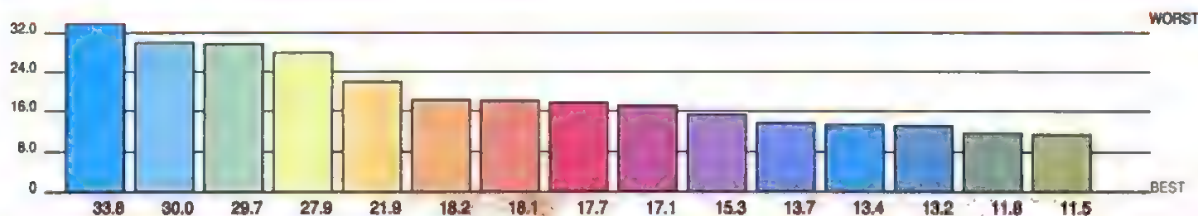
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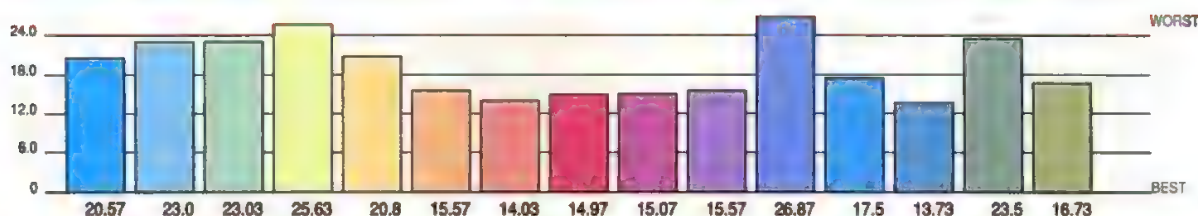
1,024-BY-768 COLOR NONINTERLACED MONITORS: PERFORMANCE TESTS

1K-MODE RESULTS

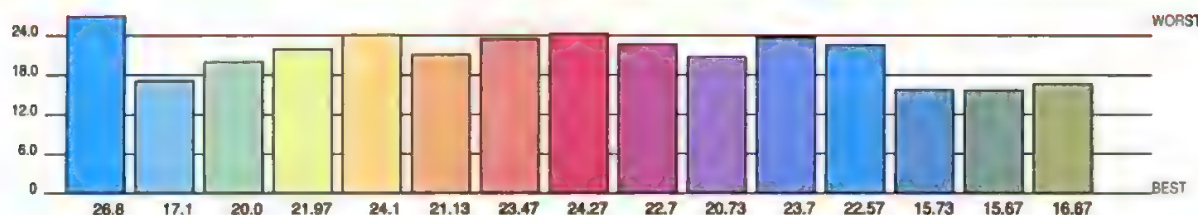
Drift



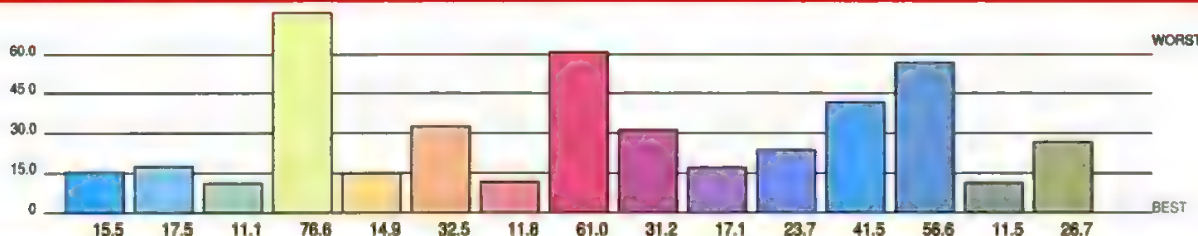
Horizontal Line Width



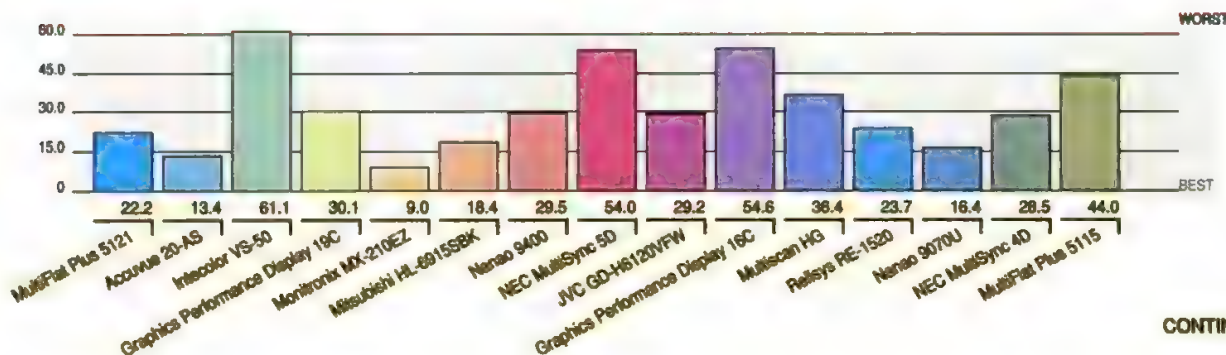
Vertical Line Width



Horizontal Pincushion



Vertical Pincushion



CONTINUES

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Daily Schedule

Thursday

8:30	Review Proposal with Lou
10:00	Finalize presentation
11:30	Lunch with Keith, Laura, & Col
2:30	Catch flight
4:05	Schedule for arrival
4:45	Meeting with WWS Inc

Designer - PHOENIX.DWG

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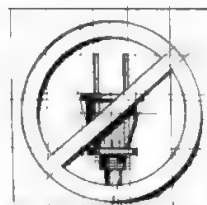
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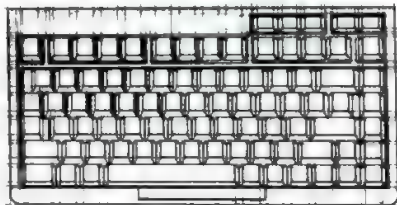
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Toshiba America Information Systems Inc., Computer Systems Division

CIRCLE 379 ON READER SERVICE CARD

PERFORMANCE TESTS: COMPOSITE RESULTS



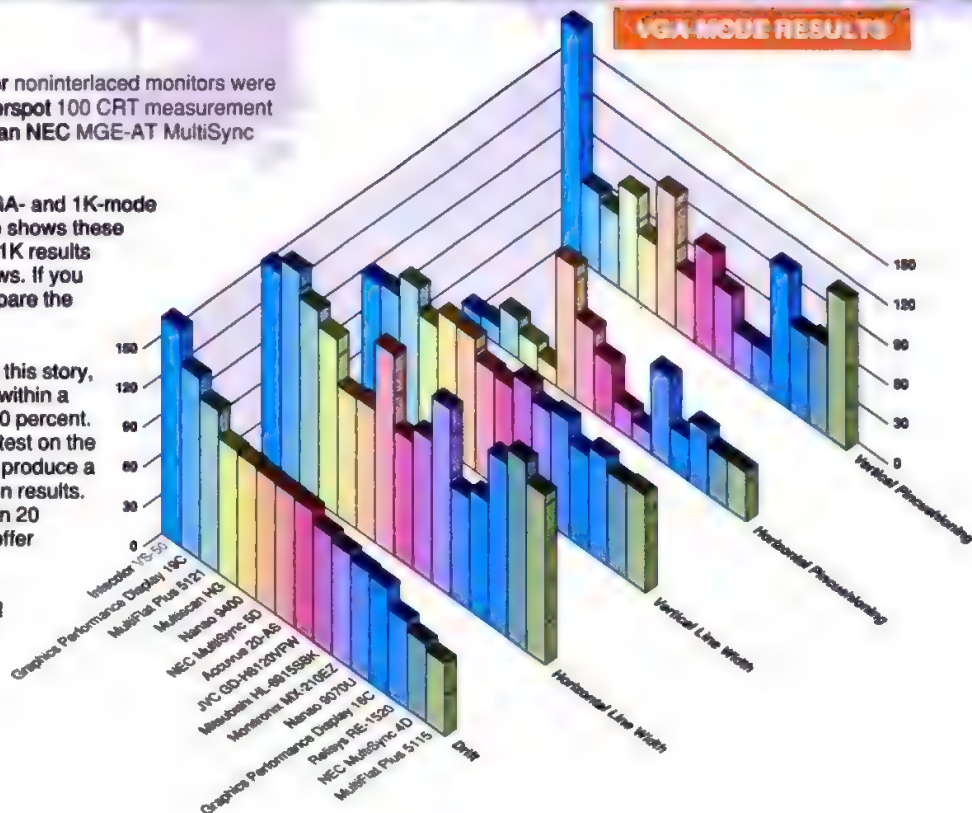
PC Labs' tests of 1,024-by-768 color noninterlaced monitors were performed using a Microvision Superspot 100 CRT measurement device, an 8-MHz IBM PC AT, and an NEC MGE-AT MultiSync Graphics Engine graphics adapter.

Note that we have reported both VGA- and 1K-mode results for the tests. Since 1K mode shows these monitors off to best advantage, the 1K results are the ones discussed in the reviews. If you use both modes, you'll want to compare the two sets of results.

When examining the test results for this story, bear in mind that they are accurate within a rather broad band of error—about 20 percent. In other words, repeating the same test on the same monitor at the same spot can produce a variation of as much as 20 percent in results. Monitors that produced results within 20 percent of each other may, in fact, offer equivalent performance.

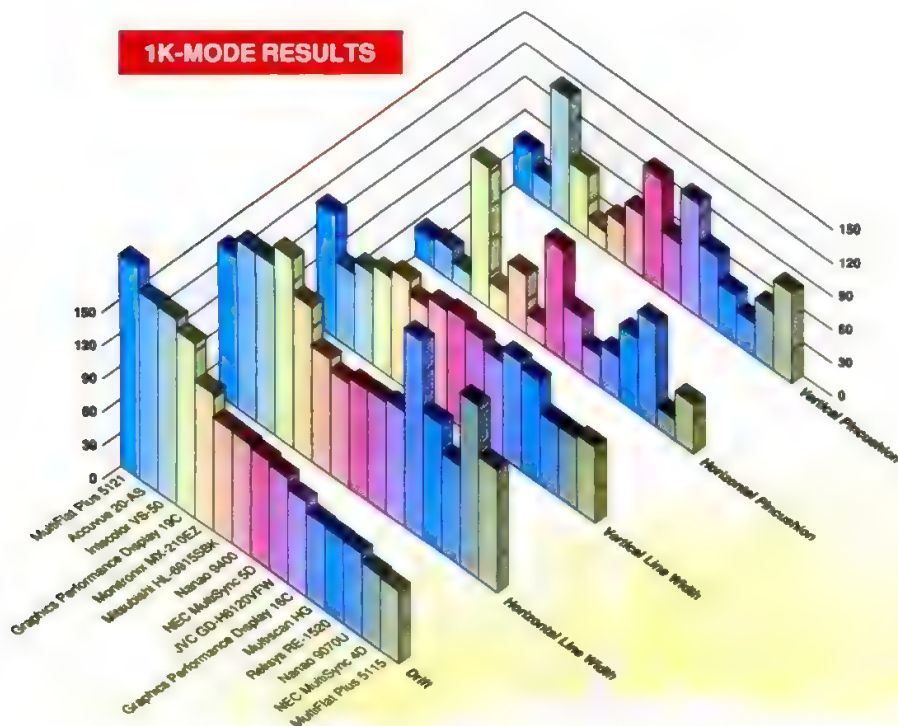
Indeed, many of the monitors tested here produced roughly equivalent performance figures. You should base your buying decisions primarily on the presence or absence of desired features.

VGA-MODE RESULTS



Relative Results
(NEC MultiSync 5D = 100)

1K-MODE RESULTS



ENDS

fers a continuous frequency range that runs from VGA up to 1,280-by-1,024 noninterlaced resolution.

In fact, the similarities go deeper, with both monitors offering similar digital controls, connectors, and even manuals. There's no mystery to the resemblance, however. The Dell is an OEMed version of the Mitsubishi HL-6905, a cousin of the Mitsubishi HL-6915SBK reviewed here.

But there are important differences between the two Mitsubishi models: they use different CRTs, and the HL-6905's focusing electronics are less sophisticated. These differences explain why Mitsubishi's HL-6915SBK outperformed Dell's 19C, which is priced \$1,300 lower.

Since Dell's 19C and the Mitsubishi HL-6915SBK share most specifications and controls, the remaining differences between them are mostly minor. For instance, the Dell has a switch to set the monitor for sync on green or external sync, while the Mitsubishi sets sync automatically.

Setting up the Dell is much like setting up the Mitsubishi. The BNC connectors on the back give you the option of using three, four, or five connectors for sync on green, external composite sync, or external separate sync. As with the Mitsubishi, the Dell's back-panel controls are limited to switches for the BNC connectors. The

power switch, the degaussing button, and thumbwheels for brightness and contrast are all on the front panel and are clearly labeled. The most important similarities between the monitors lie in their digital controls and on-board memory. Like the Mitsubishi, the Dell can store horizontal and vertical size and position settings for up to 22 display modes. Four of these 22—including three VGA modes—are preset at the factory, but all settings can be user defined.

Alas, the Dell and the Mitsubishi share the same clumsy approach to stored settings; the extensive button pushing verges on intolerable when compared with the straightforward storage of settings on, for example, the NEC MultiSync 4D. The Dell unit's saving grace is that you have to set the monitor only once for any given display mode.

All told, Dell's Graphics Performance Display 19C has more going for it than against it. The combination of digital controls, large screen, and compatibility with VGA through 1,280-by-1,024 is unusual enough to make the monitor interesting. And if the digital controls are more clumsy than they have to be, it's still far better than not having the features at all.

geometry appeared good, although testing showed it to have more than a millimeter of horizontal pincushion distortion.

You would expect a 20-inch (19 inches visible) display to be big, and the Accuvue fulfills that expectation. Size-wise, and aesthetically, the Accuvue is suited to industrial settings. Standing 18.25 by 19.5 by 19 inches (HWD) on its optional tilt/swivel base, this 72.5-pound machine crushes scales and whatever else you might put beneath it.

The big screen of the Accuvue can hold a lot of detail—over 1.3 million pixels arrayed in a 1,280-by-1,024 display. In addition, the unit explicitly supports VGA (640-by-480) and 1,024-by-768 operating modes. It locks to vertical frequencies of 55 to 80 Hz and horizontal scans of 30 to 65 KHz. Its bandwidth is an astronomical 100 MHz. Analog RGB signals with sync on green, separate sync, and composite sync are all acceptable.

Styling is but one reason why the Hitachi constitutes a stark business machine. Only the power switch and the brightness and contrast controls allow ready manipulation; the size and positioning controls, tucked behind a door on the right side of the display, require a screwdriver for adjustment. This may be a boon to PC managers who want to keep such adjusters out of the hands of their computer operators. But the arrangement will prove frustrating if you want to tweak your display without searching for the proper tool. (A plastic-



Graphics Performance Display 19C

Dell Computer Corp., 9505 Arboretum Blvd., Austin, TX 78759-7299; (800) 426-5150, (512) 338-4400.

List Price: \$2,499 (cable included).

Requires: VGA, Super VGA, 8514/A, 1,024 x 768, or 1,280 x 1,024 graphics adapter.

Diagonal Screen Size: 19 in.

In Short: The Graphics Performance Display 19C is an OEMed Diamond Scan 20L HL6905 by Mitsubishi, and it shares many features of the Mitsubishi 20L HL-6915SBK, including 20-inch screen, digital controls, and on-board memory for storing size and position settings. The Dell's lower price (\$2,499 versus \$3,790) comes from using a different CRT and less-sophisticated focusing electronics.

CIRCLE 414 ON READER SERVICE CARD

HITACHI AMERICA LTD.

Accuvue 20-AS

by Winn L. Rosch

The exterior of Hitachi's Accuvue 20-AS won't win the big monitor a place in the Museum of Modern Art. It's strictly utilitarian, almost Spartan. The skeleton of the chassis is visible through the rather wide ventilation slots atop the display, and through the large rear-panel cutout that allows access to the unit's five BNC connectors. Separate 75-ohm-termination slide switches are provided for the three video and composite sync inputs.

Although the screen is pale gray when the \$3,535 monitor (including optional tilt/swivel base) is off, light it up and you'll be rewarded by a medium-bright, sharp image with better-than-adequate contrast. The CRT, which has a .31-mm. dot pitch, is lightly coated with silica to cut down on glare.

In testing, the line width displayed by the Hitachi was about average. Its image



Accuvue 20-AS

Hitachi America Ltd., OAS Division, 6 Pearl Ct., Allendale, NJ 07401; (201) 825-8000.

List Price: \$3,535 (with tilt/swivel base; cable not included).

Requires: VGA, 1,024 x 768, or 1,280 x 1,024 graphics adapter; cable.

Diagonal Screen Size: 18.75 in.

In Short: A large, utilitarian, 20-inch color monitor with an extremely wide (100-MHz) bandwidth that is capable of resolutions of up to 1,280 by 1,024 pixels. A screwdriver is required to adjust the size and positioning controls.

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CIRCLE 21 ON READER SERVICE CARD

tipped Philips screwdriver is best.)

Three sets of these controls are available, each covering a band of self-synchronizing frequencies. One nice touch Hitachi adds is an LED indicator that lets you know what controls are active, which in turn depends upon the band of frequencies the Accuvue is operating in. The documentation accompanying the Japan-made Accuvue is as scant as that given any display. The warranty is equally typical—one year parts and labor. The Accuvue is certified FCC Class B.

Choose the Accuvue 20-AS if you need a big, sharp, utilitarian system and don't mind the inconvenience of screwdriver-adjusted controls.

INTECOLOR CORP.

Intecolor VS-50

by Alfred Poor

The VS-50 from Intecolor Corp. is a 20-inch monitor that carries a hefty \$3,795 list price. For this price, you get a good-looking unit that can produce resolutions of up to 1,024 by 768.

Unlike many other monitors tested here, the VS-50 offers only a single hook-up (a DB-15 connector) on the back of the case. There are no provisions for separate

BNC connectors (though you can get either 9-pin or BNC connections instead as an option). The unit is designed to accept a standard 75-ohm signal, with a peak analog voltage of .7. (Some other monitors offer a choice between .7 and 1 volt.)

The front of the case offers more options. There you will find the standard set of controls, including power switch, brightness, and contrast. The VS-50 has a degaussing button, which can counteract the accumulated charges that sometimes result in colored patches on-screen. Like many of the other monitors reviewed here, the VS-50 goes through an automatic degaussing cycle on power-up, but the manual button is a bonus feature.

The VS-50 also puts the image-size and -placement controls on the front panel, which is far more convenient than the back or side locations used in some competing designs. There are only two knobs, however: one for vertical adjustments and the other for horizontal. Each knob can be used to adjust both picture size and position; as with some car stereos, you can push the knobs in as you turn to create one setting, then let it pop back to its normal position to make the other setting.

Since the VS-50 can sync on any horizontal scan frequency from 30 to 50 KHz, you can feed it nonstandard frequencies. It has built-in circuitry that is optimized for the standard VGA display frequencies, and it maintains correct picture size and location when in this mode. You select this mode by setting a switch on the back of the case.

The monitor looked good in our tests, even at the high resolution. Its line-width measurements were a bit higher than some of the others, even among monitors with the same .31-mm. dot pitch. The vertical pincushioning results were a bit large, though the image did not appear distorted when working with the screen under *Microsoft Windows*. The VS-50 turned in some of the best horizontal pincushioning numbers in the group, however, which may be taken as an indication of good design and workmanship.

The weakest link in the VS-50 is its documentation. The manual contains a host of useful information, which is more than many competitors can claim, but that information is woven in with data on two other monitors. Intecolor might do well to create three separate manuals instead of a "one-size-fits-all" book.

Intecolor designed the VS-50 for more than just office work. As a result, the tilt/swivel base is a \$120 option. You can also get the unit in different cases, including rack mount, open frame, and industrial NEMA-2 (National Electrical Manufacturers Association). Intecolor can also integrate a touch-screen input option.

While the VS-50 is attractive and produces a good image, its price places it among the most expensive units we tested. Some of its optional features may make it more attractive for the industrial marketplace, but for many office applications, you may find it to be more expensive than other alternatives.

JVC INFORMATION PRODUCTS CO. OF AMERICA

JVC GD-H6120VFW

by Alfred Poor

This 20-inch monitor may come with the unlovely moniker of GD-H6120VFW, but it manages to produce a pretty picture. The \$3,995 list price may seem a bit steep until you realize that this tube can create 1,280-by-1,024 images. The 1,024-by-768 tests we ran it through were just a walk in the park.

From the front, the JVC monitor looks much like the others in the field. It sports a



Intecolor VS-50

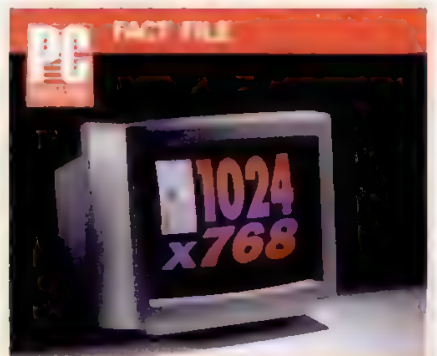
Intecolor Corp., 2150 Boggs Rd., Duluth, GA 30136; (404) 623-9145
List Price: \$3,795 (cable not included); tilt/swivel base, \$120.

Requires: VGA, Super VGA, 8514/A, or 1,024 x 768 graphics adapter; cable.

Diagonal Screen Size: Customer-specifiable; 17.2 in. recommended.

In Short: The Intecolor VS-50 may be overkill for many office applications, but it does provide industrial-strength design and performance. It produces only up to 1,024-by-768 resolution, which is one step lower than some monitors with similar sizes and prices.

CIRCLE 418 ON READER SERVICE CARD



JVC GD-H6120VFW

JVC Information Products Co. of America, 41 Slater Dr., Elmwood Park, NJ 07407; (800) 526-5308, (201) 794-3900.

List Price: \$3,995 (cable not included).

Requires: VGA, Super VGA, 1,024 x 768, or 1,280 x 1,024 graphics adapter; cable.

Diagonal Screen Size: 19 in.

In Short: Unlike most monitors in its class, which handle a variable range of frequencies, the JVC works with four fixed frequencies. The result is excellent images with resolutions up to 1,280 by 1,024. It is expensive but still a reasonable value if your needs match its capabilities.

CIRCLE 419 ON READER SERVICE CARD

power switch and the typical brightness and contrast controls along the bottom edge of the case. There is also a large degaussing button, which you can use to clean up colored patches on-screen that result from magnetized regions. Like most monitors, the JVC degausses automatically on power-up, but the manual control is a nice feature.

On the back of its case, the monitor offers both a BNC connector and a 15-pin D connector for cables. The coax connections can accept all three sync signals: on green, composite, and separate horizontal and vertical. You can hook up cables to both connector types at the same time and use a switch on the front to select between the two. This means that this one monitor can be driven by two separate video cards, or even two separate computers.

The back of the case gives a hint of one of the fundamental differences between the JVC and many other multifrequency displays. Instead of only one set of horizontal and vertical position controls, this unit has four sets. Each controls the image at a different scanning frequency. The monitor accepts signals at four fixed frequencies: 31.5 KHz for VGA signals, 37.3 KHz for 800 by 600 (also called Super VGA), 47.7 KHz for 1,024 by 768, and 63.3 KHz for 1,280 by 1,024.

This design has some significant advantages. Instead of adjusting on the fly for different frequencies, the JVC can be preset for precise performance at specific resolutions. As a result, you theoretically get better picture quality—as a fixed-frequency monitor would provide—while enjoying the flexibility of a multifrequency design. JVC also rates the video bandwidth of this monitor at 110 MHz, one of the highest in this group; this also should contribute to a better image.

The JVC monitor performed well in our tests, with relatively thin lines and fairly stable images. The *Microsoft Windows* displays were crisp, clean, and inviting.

The GD-H6120VFW offers a few other interesting differences. It has an autosensing power supply, so all you need to do when going from 110- to 220-volt operation is change a fuse. There is one thing missing from the monitor case, though—a horizontal picture-size adjustment. According to a JVC representative, this feature was not required by the OEM companies that originally asked for the monitor. These picture-sizing controls are located inside the unit, along with some other picture-adjustment controls, and can be

reached without too much difficulty.

Overall, the JVC GD-H6120VFW is an attractive, large-screen monitor that produces a high-quality image. The catch is that you must literally pay a price for its performance. If you need the high-quality pictures it can produce and will only be sending it one of the four signals it can handle, then it may well be worth the expense.

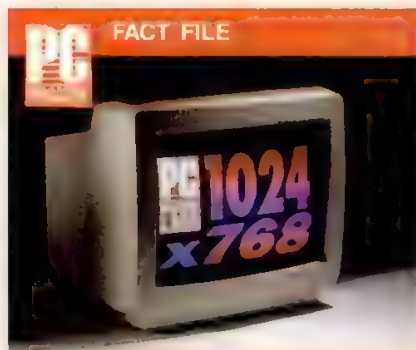
MITSUBISHI ELECTRONICS AMERICA INC.

Mitsubishi HL-6915SBK

by M. David Stone

If you're looking for a monitor that will go beyond even 1,024-by-768 resolution, you'll certainly want to look at the Mitsubishi HL-6915SBK, from Mitsubishi Electronics America. Priced at \$3,790, this 20-inch monitor with 19-inch image will handle all resolutions from VGA to 1,280 by 1,024 noninterlaced.

Setting up the monitor is straightforward. There are five BNC connectors on the back of the unit; three can be used for sync on green, four for external composite sync, or all five for external separate sync.



Mitsubishi HL-6915SBK

Mitsubishi Electronics America Inc., 991 Knox St., Torrance, CA 90502; (800) 556-1234, ext. 209; (213) 515-3993.

List Price: \$3,790 (cable not included).

Requires: VGA, Super VGA, 8514/A, 1,024 x 768, or 1,280 x 1,024 graphics adapter; cable.

Diagonal Screen Size: 19 in.

In Short: The Mitsubishi HL-6915SBK offers a 20-inch screen and support for all video modes from VGA to 1,280 by 1,024 noninterlaced. Storing settings in the digital memory is harder than it ought to be, but it's tolerable as a one-time-only task.

CIRCLE 420 ON READER SERVICE CARD

The connectors are clearly labeled, and each connection option is illustrated in the manual.

The only controls on the back of the unit are for the BNC connectors. On the front panel, you'll find the power switch, the degaussing switch, and thumbwheels for brightness and contrast, all of which are clearly labeled. Certainly the most interesting features of this monitor are its digital controls and built-in memory. The monitor can store horizontal and vertical size and position settings for up to 22 display modes. Four of these are factory settings—three VGA modes and the Mac II mode—though you can change them if you so desire. The other settings are user-defined.

Mitsubishi's approach to storing settings is somewhat arcane, as mentioned in the review of the Dell 19C, which uses a Mitsubishi model similar to the HL-6915SBK. In the simplest case, you run the monitor in the appropriate screen mode, slide a DIP switch to Adjustment mode, turn a rotary switch to the item you want to adjust (horizontal or vertical size or position, for example), push the Plus or Minus buttons to make the adjustment, store the new setting by pressing the Entry button, and finally slide the DIP switch back to Operation mode.

In general, once a setting is stored, the monitor will use that setting when it detects an input signal at that frequency. However, the automatic setting channel can only distinguish signals with horizontal scanning frequencies at least 3 KHz apart (yielding 11 autochannel settings between 30 and 64 KHz). And since some display modes may be closer together, the monitor also has so-called enhanced channels for storing additional settings for any given frequency.

All this button pushing is tolerable only because you shouldn't have to do it more than once for any display mode. A more important problem is that the procedure isn't explained well in the manual. There are even some choices on the rotary switch—PCC-AMP and PCC PHASE—that aren't explained at all. (They're for adjusting pincushioning.) Expect some false starts before you get it right.

Overall, the Mitsubishi HL-6915SBK is a highly versatile monitor with an unnecessarily difficult set of digital controls. But the only serious flaw is with the manual, and given this monitor's ability to handle everything from VGA to 1,280 by 1,024, it is clearly one you won't outgrow soon.

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COVER STORY
1024 MONITORS



1,024-BY-768 COLOR MONITORS: SUMMARY OF FEATURES

Products listed in ascending price order

	Multiscan HG \$1,095	Reisys RE-1520 \$1,099	Graphics Performance Display 16C \$1,199	MultiFlat Plus 5115 \$1,395	NEC MultiSync 4D \$1,699	Nanao 9070U \$1,779
PHYSICAL SPECIFICATIONS						
Tilt/swivel base	■	■	■	■	■	■
Visible screen size (diagonal, in inches)	13.25	12.75	15	12.25	15	15
Case dimensions (HWD, in inches)	14 x 14 x 16	16 x 15 x 17	16 x 16 x 18	12 x 14 x 16	15 x 15 x 19	15 x 17 x 18
Weight (pounds)	29	33	42	34	43	42
Length of power cable (inches)	84	72	72	76	72	48
Type of connector required	DB-9	HD-15, 4 BNC	DB-9, 5 BNC	DB-9, DB-15, 5 BNC	HD-15, DB-15, 4 BNC	DB-9, 5 BNC
Adapter cable supplied	□	■	■	■	■	■
FCC certification	Class B	Class B	Class A	Class B	Class A	Class B
COMPATIBILITY						
1,024 x 768	■	■	■	■	■	■
8514 (interlaced)	■	■	■	■	■	■
Super VGA (800 x 600)	■	■	■	■	■	■
VGA	■	■	■	■	■	■
EGA (TTL)	□	□	■	■	□	■
CGA (TTL)	□	□	□	□	□	□
Other	Mac II	None	None	Mac II	Mac II	None
OPERATIONAL FEATURES						
Maximum resolution (pixels)	1,024 x 768	1,024 x 768	1,280 x 800	1,024 x 768	1,024 x 768	1,280 x 800
Video bandwidth (MHz)	50	65	30 (TTL), 50 (analog)	30 (TTL), 50 (analog)	75	50
Vertical scanning frequency range (Hz)	50-87	50-80	50-80	50-90	50-90	50-80
Horizontal scanning frequency range (KHz)	28-50	30-50	20-50	20-50	30-57	20-50
Phosphor persistence	Medium	Medium	Short	Short	Short	Medium
Dot pitch (millimeters)	0.26	0.31	0.31	0.26	0.28	0.28
Autosizing	■	■	■	□	■	■
Inputs						
Analog	■	■	■	■	■	■
TTL	□	□	■	■	□	■
RGB	■	■	■	■	■	■
Composite	□	□	□	□	□	□
RGB sync inputs						
On green	■	■	■	■	■	■
External composite	■	■	■	■	■	■
External separate	■	■	■	■	■	■
Outputs						
Analog	□	□	□	□	□	□
TTL	□	□	□	□	□	□
RGB	□	□	□	□	□	□
Composite	□	□	□	□	□	□
RGB sync outputs						
On green	□	□	□	□	□	□
External composite	□	□	□	□	□	□
External separate	□	□	□	□	□	□

□—Editor's Choice ■—Yes □—No

1024 MONITORS

Graphics Performance Display 19C \$2,499	MultiFlat Plus 5121 \$3,295	Accuvue 20-AS \$3,535	NEC MultiSync 5D \$3,699	Mitsubishi HL-6915SBK \$3,790	Intecolor VS-50 \$3,795	Monitronix MX-210EZ \$3,795	Nanao 9400 \$3,799	JVC GD-H6120VFW \$3,995
■	■	■	■	■	Optional	■	■	Optional
19	18.25	18.75	19	19	17.25	19	19	19
21 x 20 x 21	18 x 19 x 21	18 x 20 x 19	19 x 19 x 21	19 x 20 x 21	18 x 19 x 21	19 x 19 x 21	19 x 20 x 22	19 x 20 x 21
68	79	73	60	70	63	68	82	66
70	72	72	72	70	72	72	72	72
5 BNC	DB-9, DB-15, 5 BNC	5 BNC	HD-15, DB-15, 4 BNC	5 BNC	HD-15	5 BNC	DB-9, 5 BNC	HD-15, 5 BNC
■	■	□	■	□	□	□	■	□
Class A	Class B	Class B	Class A	Class A	Class A	Class A	Class A	Class A
■	■	■	■	■	■	■	■	■
■	■	□	■	■	■	■	□	□
■	■	□	■	■	■	■	■	■
□	□	□	□	□	□	□	□	□
□	■	□	□	□	□	□	□	□
□	□	□	□	□	□	□	□	□
1,280 x 1,024, Mac II	None	1,280 x 1,024	1,280 x 1,024, Mac II	1,280 x 1,024, Mac II	Mac II	1,280 x 1,024	1,280 x 1,024	1,280 x 1,024
1,280 x 1,024	1,024 x 768	1,280 x 1,024	1,280 x 1,024	1,280 x 1,024	1,024 x 800	1,280 x 1,024	1,280 x 1,024	1,280 x 1,024
100	30 (D), 65 (BNC)	100	75 (D), 110 (BNC)	110	75	160	120	110
50-90	50-90	55-80	50-90	50-90	50-100	40-120	55-75	60-70
30-64	20-50	30-65	30-66	30-64	30-50	30-74	30-65	30-64
Medium	Short	Long	Medium/short	Short	Medium	Short	Short	Medium/short
0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31
■	□	■	■	■	■	□	■	■
■	■	■	■	■	■	■	■	■
□	■	□	□	□	□	□	□	□
■	■	■	■	■	Optional	■	■	■
□	□	□	□	□	□	□	□	□
■	■	■	■	■	□	■	■	■
■	■	■	■	■	□	■	■	■
■	■	■	■	■	□	■	■	■
□	□	□	□	□	□	□	□	■
□	□	□	□	□	□	□	□	■
□	■	□	□	□	□	□	□	□
□	□	□	□	□	□	□	□	□
□	■	□	□	□	■	■	□	■
□	■	□	□	□	■	■	□	■
□	■	□	□	□	□	■	□	■

CONTINUES

1,024-BY-768 COLOR MONITORS: SUMMARY OF FEATURES

Products listed in ascending price order

	Multiscan HG	Relsys RE-1520	Graphics Performance Display 16C	MultiFlat Plus 5115	NEC MultiSync 4D	Nanao 9070U
CONTROLS						
Brightness	Analog	Analog	Analog	Analog	Analog	Analog
Contrast	Analog	Analog	Analog	Analog	Analog	Analog
Color	None	None	None	None	None	None
Horizontal position	Analog	Analog	Analog	Analog	Digital	Analog
Vertical position	Analog	Analog	Analog	Analog	Digital	Analog
Horizontal size	Analog	Analog	Analog	Analog	Digital	Analog
Vertical size	Analog	Analog	Analog	Analog	Digital	Analog
Color selector for text	None	None	Analog	None	None	None
120/240-volt switch	None	None	None	None	None	None
Degaussing	None	None	None	None	Digital	None
8/16/64-color switch	None	None	Analog	Digital	None	Analog
Pincushioning	None	None	Analog	None	None	Analog
Convergence	None	None	Analog	None	None	Analog

☐ Editor's Choice
☒ Yes
☐ No

MONITRONIX INC.

Monitronix MX-210EZ

by Alfred Poor

If you want your equipment to give the impression of industrial-strength design, the Monitronix MX-210EZ should fit the bill. Its packaging is about as utilitarian as its name, but this \$3,795 19-inch color monitor can give you images of up to 1,280 by 1,024 resolution.

Our tests required only about half that detail, and the monitor produced good-quality images. It also maintained its picture size and location when switching between the high-resolution mode and the VGA signals.

The MX-210EZ handles different frequencies in an unusual way. Like a multiple-fixed-frequency monitor, it has circuits designed to handle a number of frequencies; like variable-frequency monitors, it handles these frequencies within ranges. There are three ranges that the MX-210EZ handles: 30–40 KHz, 40–55 KHz, and 55–74 KHz.

You can tune the image for optimum performance with different signals in these ranges, and therein lies one of the rubs about this monitor. The large, boxy case has a fairly featureless back panel, with five BNC connectors and a number of

small holes that give you access to adjustment potentiometers. All of these holes are identified in the manual, but many are not labeled on the back plate.

Now, you certainly shouldn't make adjustments to such a complex piece of equipment without first reading the manual. But just as certainly, Monitronix should label these holes. Other controls that you might need to adjust are hidden inside the case; you have to remove the back panel to reach them.

Some of the holes that are labeled are the horizontal and vertical settings for image position and size. There are three sets of these four controls—one for each horizontal frequency range—and each set is labeled Lo, Med, or Hi. There is also a degaussing button; this can help alleviate picture-impurity problems that arise from shifting magnetic fields or from moving the monitor while it is on.

The front panel of the monitor is quite different from the complex back. It has only two controls—a power switch and a brightness control. This is remarkable because there is no corresponding contrast control. Black levels are set using the controls on the back of the case, and since the background of our images was clear and black, there was no need to touch them for our tests.

The MX-210EZ did well in our tests, although its line widths were a bit thicker than many of the other monitors. The pin-

cushion results were very good in both directions, and the image looked good under *Microsoft Windows* in both resolutions. The monitor's video-bandwidth specifications, among the highest in the group, may partly account for its good image.

Monitronix backs up its product with an outstanding warranty. The company promises to replace a defective unit within



Monitronix MX-210EZ

Monitronix Inc., 929 Eastwind Dr., #220, Westerville, OH 43081-3329; (800) 365-5646, (614) 891-3232.

List Price: \$3,795 (cable not included).

Requires: VGA, Super VGA, 8514/A, 1,024-x-768, or 1,280-x-1,024 graphics adapter; cable.

Diagonal Screen Size: 19 in.

In Short: The Monitronix MX-210EX is built like a tank and backed by an outstanding 90-day replacement warranty in addition to the standard one-year parts-and-labor coverage. It handles up to 1,280-by-1,024 resolution and represents an acceptable value for its size and features.

CIRCLE 421 ON READER SERVICE CARD

CONTRAST 1024 MONITORS

Graphics Performance Display 19C	MultiFlat Plus 5121	Accuvue 20-AS	NEC MultiSync 5D	Mitsubishi HL-6915SBK	Intecolor VS-50	Monitronix MX-210EZ	Nanao 9400	JVC GD-H6120VFW
Analog	Analog	Analog	Analog	Analog	Analog	Analog	Analog	Analog
Analog	Analog	Analog	Analog	Analog	Analog	Analog	Analog	Analog
None	None	None	None	None	None	None	None	None
Digital	Analog	Analog	Digital	Digital	Analog	Analog	Analog	Analog
Digital	Analog	Analog	Digital	Digital	Analog	Analog	Analog	Analog
Digital	Analog	Analog	Digital	Digital	Analog	Analog	Analog	Analog
Digital	Analog	Analog	Digital	Digital	Analog	Analog	Analog	Analog
None	Analog	None	None	None	None	None	None	None
Digital	Analog	None	None	Digital	None	Analog	None	None
Digital	None	None	Digital	Digital	Analog	None	None	Analog
None	Analog	None	None	None	None	None	None	None
Digital	None	None	None	Digital	None	Analog	None	Analog
None	None	None	None	None	None	Analog	Analog	None

ENDS

48 hours if anything should go wrong within the first 90 days, even if the initial problem is caused by shipping damage. Diagnostic lights are located on the back of the monitor case, making it easy to identify the cause of most problems.

Monitronix sets up every monitor to custom specifications before shipping so that each will be adjusted correctly for its display adapter. And in spite of its type-written format, the unit's documentation is highly informative and accessible.

The Monitronix MX-210EZ isn't lovely to look at, but it does create lovely pictures. And though it falls in the high end of the price range, its quality of design and construction may justify the investment.

NANAO U.S.A. CORP.

Nanao 9070U

by Winn L. Rosch

While Nanao is known, at best, as Japan's other monitor maker, the 9070U should cause some rethinking of that. This 16-inch \$1,799 display produced one of the sharpest scans among the monitors tested and can handle resolutions up to 1,280 by 800 (within the 50-MHz bandwidth).

The secret to the 9070U's high resolution is a sharp (.28-mm. dot pitch) CRT with a contrast-enhancing dark matrix and

antiglare treatment. Its electronics synchronize with vertical scanning frequencies from 50 to 80 Hz and horizontal frequencies from 20 to 50 KHz. It even tiptoes out of that range to handle the interlaced signals of IBM's 8514/A adapter.

The 16-inch tube of the 9070U is masked down to 15 inches by a battleship-gray bezel; the cabinet is certified for FCC Class B compliance. At 15.75 by 15.75 by 17.5 inches (HWD), including the built-in tilt/swivel base, the 9070U appears somewhat chunky, but it will comfortably nestle atop any PC than can handle its 40-pound bulk.

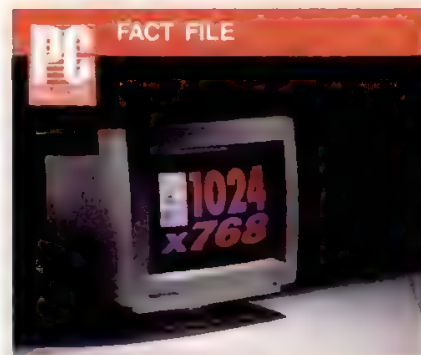
The 9070U's low-reaching frequency range and its ability to handle both digital and analog inputs make it backward-compatible with IBM's EGA standard, as well as with VGA and 1,024-by-768 signals. Note, however, that it will not handle CGA operating modes generated by EGA graphics adapters (such CGA frequencies are too low); it will display, however, the double-scanned CGA images made by VGA adapters.

The 9070U handles image sizing automatically, but its size and position controls are global: only one standard can be optimally tweaked. A switch on the rear panel toggles between analog and TTL signals (a companion slide switch selects 8-, 16-, or 64-color digital operation). Analog signals couple through the 9070U's five rear-panel BNC connectors or can use the female 9-

pin D connector that also serves digital signals.

A front-panel switch controls whether the BNC or D connector is active. Nanao includes a 15-pin to 9-pin adapter for VGA signals in addition to the 4-foot-long 9-pin to 9-pin signal cable. Separate sync, composite sync, and sync on green are all accommodated.

Nanao puts all other normal user con-



Nanao 9070U

Nanao USA Corp., 23510 Telo Ave., #5, Torrance, CA 90505; (213) 325-5202.

List Price: \$1,779 (EGA and VGA BNC cables and VGA adapter included).

Requires: EGA, VGA, Super VGA, 8514/A, or 1,024 x 768 graphics adapter.

Diagonal Screen Size: 15 in.

In Short: A high-resolution, 16-inch color monitor with tightly focused beams, digital and analog inputs, and a maximum resolution of 1,280 by 800 pixels.

CIRCLE 422 ON READER SERVICE CARD

trols under the front edge of the display. Contrast and brightness, as well as horizontal and vertical size and position adjustments, are all available as center-detented thumbwheels (brightness lacks a detent). Also present is a text-mode switch that has three positions: color, white on black (essentially a monochrome setting), and amber on black. Text mode is available with either digital or analog inputs.

Although thin, the Nanao documentation is complete and clearly written, and the 9070U carries a one-year parts-and-labor warranty. Its sharp display, 16-inch size, and backward compatibility with EGA make the Nanao 9070U an intriguing monitor. However, it lacks the bandwidth and frequency range to take advantage of its full high-resolution capabilities.

NANAO U.S.A. CORP.

Nanao 9400

by Alfred Poor

The company name may sound like a spin-off from "Mork and Mindy," but the 20-inch Nanao 9400 can produce 1,280-by-1,024 images that are out of this world. The \$3,799 list price, however, might send your budget into orbit.

The 9400 is full-featured. It comes with nearly every control and attribute you

might want on a high-resolution monitor. To start with, it automatically syncs to horizontal scanning frequencies of 30 to 60 KHz. Its rated signal bandwidth is 120 MHz, one of the best in the field, so it should have the power to maintain crisp images even at high resolutions.

The back of the case demonstrates some of this monitor's flexibility. There is a 9-pin D connector suitable for PC graphics adapters. There are also five BNC connectors for coaxial cables. The 9400 can accept coaxial signals in all three common configurations: sync on green, composite sync, and separate vertical and horizontal sync.

Turn to the front of the case and you'll find all the controls you might need conveniently arranged along the bottom edge. There is a power switch with an indicator light above it, as well as a degaussing button that can help clear the screen of accumulated charges. There are the standard brightness and contrast controls, as well as picture size and position controls for adjusting the horizontal and vertical dimensions of the image.

The 9400 also has a switch on the front panel that allows you to accept your input signal from the BNC or the D connector. This allows you to hook up two graphics adapters (or even two computers) and switch from one to the other.

The back of the monitor offers two more controls. There is a knob that allows you to adjust for video signals that are not at the peak voltage of .7. There is also a hole that gives you access to an adjustment for the horizontal convergence of the center of the screen.

The Nanao 9400 performed well in our tests, producing relatively fine lines (though the horizontal line-width results were better than the vertical ones). The pincushioning figures were above average, and the overall image looked good under *Microsoft Windows* at both VGA and 1,024-by-768 resolutions. Even with the image extended to the edge of the bezel, there was no obvious loss of picture quality. The documentation is a little thin but should serve most purposes; the case is attractive and includes a tilt/swivel base.

If you need a large monitor capable of going beyond 1,024-by-768 resolution, the Nanao 9400 can handle the job. While its price is among the highest in this group, it represents a good value for its resolution, size, and image quality.

NEC TECHNOLOGIES INC.

NEC MultiSync 4D

by M. David Stone

Similar to the MultiSync 5D, the MultiSync 4D from NEC Technologies is best thought of as a smaller, less expensive alternative to the 5D. The \$1,699 4D sports a 16-inch screen with 15-inch image. And although it can't match the 5D, it is the least expensive MultiSync monitor to offer noninterlaced 1,024-by-768 resolution.

The "D" in 4D is for *digital*, and the digital controls and memory are among the monitor's key features. In addition to automatically adjusting to any frequency between PGC or VGA on up to 1,024 by 768, the monitor can store size and position settings for up to 17 display modes.

The 4D's approach to storing settings is elegant in the extreme. It ships with built-in settings for nine standard modes, including each of the VGA modes. To change any of these, or to add a setting for a nonstandard mode, simply run the monitor in the appropriate mode and use the digital controls on the front panel to set the horizontal and vertical size and position. After a few seconds without change, the monitor memorizes the settings and will automatically use those settings for that frequency until told otherwise.

You can change the settings at any time, or you can recall the factory settings



Nanao 9400

Nanao U.S.A. Corp., 23510 Telo Ave., #5, Torrance, CA 90505; (213) 325-5202.

List Price: \$3,799 (VGA cable included)

Requires: VGA, Super VGA, 1,024 x 768, or 1,280 x 1,024 graphics adapter.

Diagonal Screen Size: 19 in

In Short: The Nanao 9400 may seem expensive, but it is right in step with other 20-inch color monitors that produce 1,280-by-1,024 images. It includes the ability to connect to two display cards (or computers) at the same time.

CIRCLE 423 ON READER SERVICE CARD



NEC MultiSync 4D

NEC Technologies Inc., 1255 Michael Dr., Wood Dale, IL 60191; (708) 860-0335.

List Price: \$1,699 (cable included).

Requires: VGA, Super VGA, 8514/A, or 1,024 x 768 graphics adapter.

Diagonal Screen Size: 16 in.

In Short: The 16-inch NEC MultiSync 4D is the lowest-priced monitor in the MultiSync line to support 1,024-by-768 noninterlaced resolution. It can store settings in its digital memory.

CIRCLE 424 ON READER SERVICE CARD

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PC Magazine said: "The excellent processor performance and expansion capability of the KEEN-3304 make it a very good network file server."

25MHz. The KEEN-2500 Series has the same lightning fast cache memory scheme as the 33MHz and delivers 6.2 MIPS. It's Novell Certified for use with NetWare, and XXCAL Labs certified for compatibility with a long list of hardware, operating systems and, of

course, the latest high-performance software.

Personal Workstation said: "The caching strategy and overall cache and board design undoubtedly affect system performance, boosting the DTK (KEEN-2500) to one of our top performers... one of the best high-performance bargains we've seen."

Key Features	KEEN-3300 Series	KEEN-2500 Series	KEEN-2000 Series	PEER-1630 Series
Processor	80386-33	80386-25	80386-20	80386SX-16
Configurations				
Tower Model	KEEN-3304	KEEN-2503	KEEN-2000T	—
Desktop Model	KEEN-3302	KEEN-2500	KEEN-2000D	PEER-1632
Mini-AT Model	—	—	—	PEER-1630
DRAM on Motherboard	Up to 8MB	Up to 8MB	Up to 1MB	Up to 5MB
32-bit DRAM (max.)	16MB	16MB	17MB	5MB
Cache Memory	64/256KB	64/256KB	—	—
Landmark Rating	59MHz	44MHz	27MHz	20MHz

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CIRCLE 102 ON READER SERVICE CARD

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CIRCLE 742 ON READER SERVICE CARD

for the standard modes with a Memory Recall button (also on the front panel). As you might expect, this ability to change settings easily allows you to use the monitor with any 1,024-by-768 card without any special setup from NEC.

Cabling the monitor to your system is almost as easy as using it. On the back, you'll find a high-density 15-pin D connector (for use with the Mac II), a DB-15 connector, and a set of four BNC connectors. If you have a VGA, Super VGA, or one of many high-resolution boards, you can simply plug in the supplied cable. If you have a PGC card, you will also need a 15- to 9-pin adapter. Alternatively, you can use the BNC connectors. With four BNC connectors available, you can choose between external composite sync and sync on green.

Note that if your high-resolution adapter doesn't support VGA, you can connect the monitor to a VGA board also. A switch on the front panel will let you change between the BNC input and the D-sub input.

Other controls on the front of the monitor include the power switch, the brightness and contrast thumbwheels, and the digital controls already mentioned. The only controls on the back are the sync switch and degaussing button, neither of which you'll need very often. All controls are clearly labeled and work as advertised.

The only real weakness of the MultiSync 4D is the manual, which is somewhat lean, often confusing, and occasionally wrong. (For example, the manual incorrectly states that you must use the BNC connectors for a 1,024-by-768 adapter.) Fortunately, the monitor itself is so well designed that once you get it working, you can largely ignore the manual.

If you want a monitor for VGA level and up, the NEC MultiSync 4D is an excellent choice.

NEC TECHNOLOGIES INC.

NEC MultiSync 5D

by Alfred Poor

Who would have thought it possible? How could that original MultiSync monitor, the one that put multiscanning monitors on the PC map, grow into a behemoth like this? But there you have it, the NEC MultiSync 5D: a 20-inch monitor capable of displaying an impressive 1,280 by 1,024 pixels per screen in full color. The list price might

impress you, too: \$3,699.

Before you get discouraged by the price, note that it is right in line with the competitors in its class. And also consider the extras you get. Where others offer the same old dial controls for picture size and position settings, the NEC has tidy pairs of buttons with arrows as legends. These keys to the digital settings can be used to unlock some of the 5D's special features.

The monitor comes factory-set for nine common video signals, including the three VGA resolutions (640 by 350, by 400, and by 480), 800 by 600, 1,024 by 768, and 1,280 by 1,024. There are also presets for 8514/A, Macintosh II, and PGC signals. You can make adjustments to the screen settings for these different signals, and they will be stored automatically. The result is that your picture size and location will be maintained even as you switch from one video signal to another.

Should you have some special application that produces scanning frequencies different from these standard nine settings, you can use the eight user settings to custom-store them. Altogether, you have a total of 17 stored sets of picture settings.

The back panel also offers some handy features. There are both mini and standard 15-pin D connectors. There are also four BNC coaxial connectors. You can hook up



NEC MultiSync 5D

NEC Technologies Inc., 1255 Michael Dr., Wood Dale, IL 60191; (800) 826-2255, (708) 860-0335. List Price: \$3,699 (cable included).

Requires: VGA, Super VGA, 8514/A, 1,024 x 768, or 1,280 x 1,024 graphics adapter. Diagonal Screen Size: 20 in.

In Short: The NEC MultiSync 5D is an impressive monitor compared to smaller screens with lower resolutions, but there are other choices in the same price range that offer the same 1,280-by-1,024 resolution on a 20-inch screen. The 5D's image is on a par with the others, and its digital settings can accommodate as many as 17 different types of video signals.

CIRCLE 426 ON READER SERVICE CARD

a display adapter to a D connector and another to the coaxial connectors, then use a switch on the front panel to toggle back and forth between the two images.

The 5D produced good images, though there was a visible convergence problem in the upper-left corner: something that could probably be corrected via internal adjustments. The test results indicate that the 5D should produce an image about as good as the others in its class, which the look of the high-resolution image under *Microsoft Windows* confirmed.

The documentation that comes with the NEC 5D is among the best in the group. NEC stands behind its product with a typical one-year labor warranty, but it doubles the standard in offering two-year coverage for parts, including the picture tube.

The 5D is unusual in its class because it is designed as a mass-market device, while most competing designs are meant to be custom-tuned for each specific installation before leaving the factory. This is a benefit for those who intend to use one monitor on a variety of computers. The list price is similar to the competition's, but given the discounts usually offered on NEC equipment, the street price for the 5D may represent an attractive value for a 20-inch monitor capable of 1,280-by-1,024 images.

PIXELINK CORP.

MultiFlat Plus 5115

by M. David Stone

Manufactured in Japan by IDEK, the Iiyama Electric Company, and available from U.S. importer Pixelink Corp. as well as Agora Enterprises, the \$1,395 MultiFlat Plus 5115 challenges the proposition that bigger is better. Sporting a 15-inch screen with a 14-inch image, the 5115 offers up to 1,024-by-768 noninterlaced resolution in a package that weighs only 34.2 pounds. That makes it literally a lightweight among the monitors reviewed here, but it is no lightweight performer.

The 5115's frequency range runs continuously from EGA level to noninterlaced 1,024 by 768, covering PGC, VGA, Super VGA, 8514, and Mac II. The unit as shipped will work with any 1,024-by-768 card without special setup by Pixelink.

Adding to the monitor's flexibility are three sets of connectors on the back of the unit. These include a DB-9 TTL connector for an EGA board and both DB-15 and

BNC connectors for analog signals. If you use the BNC connectors, you can connect three, four, or five connectors, depending on whether your video board provides external separate sync, external composite sync, or composite sync on green.

In addition to giving you a choice of connections, the three sets of connectors let you plug in a second video board—a useful feature if your 1,024-by-768 board doesn't offer EGA or VGA support. One annoyance for dual cabling is that the control for switching between connectors is on the back of the unit.

Assuming you have the right cable (or cables), setup consists of plugging in the cable and power cord and turning the monitor on. Missing from the 5115 is any auto-sizing feature, so that you may have to re-adjust the analog controls every time you change modes. Alas, the horizontal and vertical size and positioning controls are on the back of the unit, making manual adjustment clumsy.

According to Pixelink, a memory-resident utility for adjusting positioning by keyboard command is shipping, although it wasn't provided for this review. A utility for adjusting size is being beta-tested as of this writing.

Controls on the front of the monitor include brightness, contrast, and three text-color buttons that offer a total of seven color choices for monochrome text. The controls are clearly marked, but not all are explained well in the skimpy manual.



MultiFlat Plus 5115

Pixelink Corp., 8 Kane Industrial Dr., Hudson, MA 01749; (508) 562-4803.

List Price: \$1,395 (cable included).

Requires: EGA, VGA, Super VGA, 8514/A, or 1,024 x 768 graphics adapter.

Diagonal Screen Size: 12.25 in.

In Short: The 15-inch MultiFlat Plus 5115 provides a lightweight (34-pound) solution to covering the full range of EGA to noninterlaced 1,024-by-768 resolution. Its combination of small size and Class B rating make it a good candidate for the home office.

CIRCLE 416 ON READER SERVICE CARD

The Flat part of the MultiFlat name refers to the square flat tube technology. The CRT is flat in one dimension but curved in the other. Unlike a truly flat screen, which gives a convex appearance, the square flat tube looks flat.

In testing, the 5115 produced average to very good results across the board, chalking up the lowest score—although an acceptable one—on the Drift test. One last feature worth mentioning is the unit's FCC Class B rating, which makes the MultiFlat Plus 5115 suitable for home use. This rating, its small size, and its extreme flexibility in setup help make this monitor interesting, despite its lack of convenience features such as autosizing.

PIXELINK CORP.

MultiFlat Plus 5121

by Alfred Poor

The MultiFlat Plus 5121 is big—it's built on a 21-inch tube—and it produces high-resolution 1,024-by-768 images. It also has the lowest list price among the monitors in the 20-inch class that were tested for this article: \$3,295.

The 5121 is sold by Pixelink Corp., a distributor of high-resolution monitors that also imports European-made Philips monitors. In general, Pixelink tunes each monitor to meet the needs of the individual installation as a standard procedure.

The 5121 offers significantly more features than monitors costing hundreds of dollars more. The back panel, for example, has two sets of five BNC coaxial cable connectors; most of these monitors provide only one set. These connectors allow the video signal to pass through to another display, such as a video projector. Though this capability might be infrequently needed in an office environment, it can be extremely useful in industrial settings.

The back panel also sports a pair of D connectors. One has 15 pins and is designed to accept analog signals, such as those from a VGA or high-performance display card, and the other has nine pins and accepts digital (TTL) signals, such as those from an EGA card. The front panel includes a source-selection switch that lets you plug in cables from two sources and switch between them right from the monitor.

The 5121 can handle a wide range of signals. It accepts horizontal frequencies of 21.8 to 50 KHz. While this is a smaller range than the 1,280-by-1,024 monitors cover, it does include most of the frequencies used by PC graphics adapters. If there is a weak link here, it is in the video bandwidth specification; while many monitors in this class have specs in excess of 100 MHz, the 5121 is rated at only 65 MHz for the coaxial connectors and just 30 MHz for the D connectors.

The unit's front panel is full-featured. There are brightness, contrast, and manual degaussing controls within easy reach. The monitor also has horizontal and vertical position and size controls in front. There are even three switches that can be used to select a text screen color, affording you more than the normal amber, green, and white options. The documentation is thorough and easy to use. There are plenty of illustrations and useful charts. One interesting detail is that the monitor carries an FCC Class B rating, which is unusual for this class.

The 5121 produces a good image and performed well on most of our tests. The high-resolution images under *Microsoft Windows* looked good. This monitor combines an attractive price with desirable features and decent performance. If you do not need to go higher than 1,024-by-768 resolution and can take advantage of some



MultiFlat Plus 5121

Pixelink Corp., 8 Kane Industrial Dr., Hudson, MA 01749; (508) 562-4803.

List Price: \$3,295 (cable included).

Requires: EGA, VGA, Super VGA, 8514/A, or 1,024 x 768 graphics adapter.

Diagonal Screen Size: 18.25 in.

In Short: The MultiFlat Plus 5121 is a 21-inch monitor capable of 1,024-by-768 images and offering plenty of useful features at a competitive price. It is one of the few machines in its class that can accept both digital and analog signals, and the front-panel controls include a switch for selecting signal source, allowing you to hook it up to more than one adapter card or computer at a time.

CIRCLE 417 ON READER SERVICE CARD

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PC MAGAZINE, SEPTEMBER 12, 1989

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PC MAGAZINE, SEPTEMBER 12, 1989:

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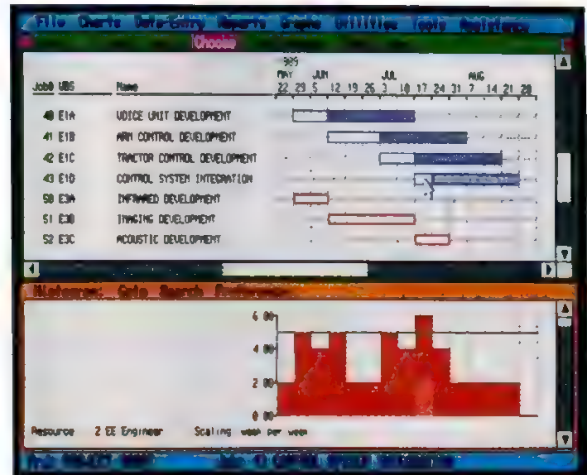
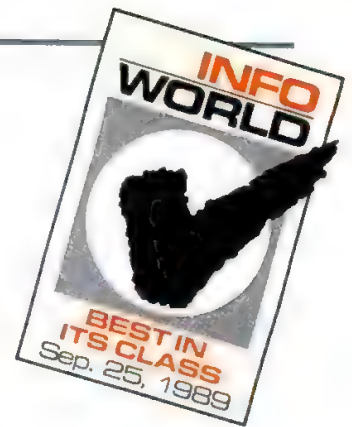
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INFO WORLD, SEPTEMBER 25, 1989:

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of the flexible features this monitor has to offer, then you should be sure to consider the MultiFlat Plus 5121.

RELISYS

Relisys RE-1520

by Winn L. Rosch

High-resolution displays typically demand you make two concessions: enough cash to wipe out the debt of a minor Third World nation and a section of your desktop big enough for sheep farming in Australia. But the Relisys RE-1520 is not your typical display. At \$1,099 retail, expect this attractive and amazingly compact 15-inch multiscanning monitor to be discounted well into the affordable range.

The highlight of the \$1,099 display is its CRT, which has a .31mm dot pitch. Amazingly close to flat-faced, the tube is masked down to an effective 14-inch diagonal and has an extremely dark matrix and good antiglare treatment. The tube of the review unit proved to be slightly askew in the set, visibly misaligned with the edges of the screen bezel.

When adjusted for its maximum usable image, the RE-1520 produced a 14-inch (diagonal) display with less than half a millimeter of pincushion distortion. Its effective line width is thickish for its screen size, both in appearance and in testing. Although hardly the sharpest screen, the Re-

lisys image is adequately crisp for most high-resolution work.

Marring this monitor's overall performance is its full-screen illumination. At high resolution, the RE-1520 screen was very dim and very inconsistent. Brightness varied by more than a factor of two from the lower-left corner to the center of the screen. At VGA resolution, however, the screen proved more than twice as bright.

According to Relisys, the high-voltage circuitry of the RE-1520 is being adjusted to yield more brightness on-screen. You won't want to use an unadjusted RE-1520 near a window or in a bright office.

Relisys puts all the most-needed controls on the front panel, where they belong. Horizontal thumbwheels on the lower left of the front bezel adjust brightness and contrast. A door just to the right of these controls hides the four small knobs that control horizontal and vertical size and positioning. On the rear panel, three slide switches select which input connectors are to be used, the nominal input signal level (1.0 or .7 volts), and whether autosizing will be manual or automatic.

Input connections can be made to either a VGA-style 15-pin high-density D shell or four BNC connectors. Both types support composite sync and sync on green; the VGA connector also links separate sync.

The Relisys manual is brief but inclusive, documenting everything that's necessary with little chaff or detail outside of timing charts and specifications. The warranty on this Taiwan-made unit is two years on parts, 15 months on labor; FCC certification is Class B.

If you want a display that looks good both on and off, one that gives you detail without demanding you concede your desktop and lunch money for the next decade, the RE-1520 is an attractive choice.

COVER STORY

1024 MONITORS



EDITOR'S CHOICE

- Nanao 9400
- NEC MultiSync 4D
- Multiscan HG

The 15 1,024-by-768 noninterlaced color monitors reviewed in this issue embody impressive quality. All had attractive displays, and all performed within an acceptable range on PC Labs tests. Editor's Choices in this product class are truly the cream of the crop.

For traditional users whose primary high-resolution applications are desktop publishing and CAD, the larger 1,024-by-768 monitors (19- to 20-inch diagonals) make the most sense. They offer the working space needed to display detailed technical drawings and layouts. Although all the larger monitors reviewed here were spectacular, the \$3,799 Nanao 9400 looked a bit better, with no obvious loss of picture quality.

Among the 13- to 16-inch monitors, two really shine: Sony's \$1,095 Multiscan HG and the \$1,699 NEC MultiSync 4D. The 13-inch Multiscan had a noticeably sharper display, and the 16-inch NEC MultiSync 4D, with its elegant stored settings and digital controls, is a design tour de force. Expect to see 16-inch monitors, which provide a third more screen area than 13-inch displays, emerge as the de facto standard for graphical PCs.

though the 13-inch Multiscan HG may change that. This \$1,095 color display proved to be an excellent choice for presentation graphics and color desktop publishing, though less desirable for CAD.

More compact than its Sony predecessors with similar screen sizes, the Multiscan HG's pale-beige plastic case tapers toward the rear, measuring 14 by 13.75 by 16 inches (HWD), including the built-in tilt/swivel base. Its 50-MHz bandwidth pushes its resolution limit to 1,024 by 768 pixels, interlaced or noninterlaced; it accepts horizontal frequencies in the range 28 to 50 KHz and vertical frequencies of 50 to 87 Hz. It is compatible with IBM's 8514/A display adapter.

Only analog inputs are accepted by the



Relisys RE-1520

Relisys, 320 S. Milpitas Blvd., Milpitas, CA 95035; (408) 945-9000.

List Price: \$1,099 (15-pin analog cable included).

Requires: VGA, Super VGA, 8514/A, or 1,024-x-768 graphics adapter.

Diagonal Screen Size: 12.75 in.

In Short: An attractive color display offering 1,024-by-768 images on a CRT of .31-mm. dot pitch. An unevenly illuminated image.

CIRCLE 426 ON READER SERVICE CARD

SONY CORP.

Multiscan HG

by Winn L. Rosch

Sony has a remarkable reputation for sharp televisions as well as video and Macintosh monitors based on the amazing Trinitron picture tube, which uses in-line guns and a mask with vertical slots rather than circular dots. In the PC community, reaction to Sony's monitors has been more equivocal,

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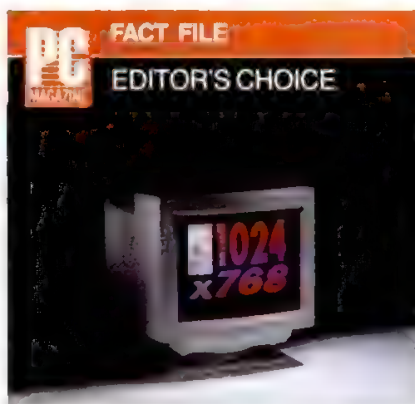
COVER STORY 1024 MONITORS

lonely 9-pin D connector on the unit's rear panel; it will lock to images based on either separate sync, composite sync, or sync on green. The input lines are permanently terminated. The input cable is optional; a 48-inch 15- to 9-pin cable costs \$25.95.

Trinitrons look and test differently than ordinary dot matrix picture tubes. The slotted design means that nothing limits the spread of horizontal lines, while vertical lines bump into the mask area between the slots. As a result, horizontal lines are apparently brighter than vertical lines—an effect virtually invisible on images with an illuminated background, but readily apparent on CAD wireframes. Trinitron tubes also differ from conventional screens in that they are curved in only one dimension. The Trinitron face is cylindrical rather than spherical, though nevertheless quite convex.

On our tests, the Multiscan HG drew wide lines (over 20 mils) despite having a very fine, .26-mm. dot pitch. Subjectively, however, the Multiscan HG looked sharp; the wider lines smooth over the separations between pixels.

Controls on the Multiscan HG are minimal. Brightness and contrast thumbwheels



Multiscan HG

Sony Corp., Computer Peripheral Products Division, One Sony Dr., Park Ridge, NJ 07656; (201) 930-1000.

List Price: \$1,095 (cable not included).

Requires: VGA, Super VGA, 8514/A, or 1,024 x 768 graphics adapter; cable.

Diagonal Screen Size: 13 in.

In Short: A 13-inch Trinitron (slotted mask) monitor with a cylindrical face, a .26-mm. phosphor pitch, and analog inputs. Capable of producing VGA through 8514 and 1,024-by-768 noninterlaced images; especially good for DTP.

CIRCLE 427 ON READER SERVICE CARD

are located under the left-front edge of the screen, a power-on push button on the right. On the left side is a recessed panel for the horizontal and vertical size and positioning controls, as well as a switch marked "Lock/Adj." "Lock" sets the Multiscan HG for full IBM 8514 compatibility with image sizing determined by sync polarity. Slide the switch to "Adj" and you can fine-tune the size of any image using the controls.

Documentation is scant: ten pages in English duplicated in French. Although a timing chart is included, the pin-out of the proprietary 9-pin video connector is not documented. In fact, the bulk of the thin manual is devoted to a listing of the control functions and instructions for using the tilt/swivel base. Sony warrants the Trinitron tube for two years and the other Multiscan HG parts for one. Labor is covered for only 90 days. The Japan-made monitor is FCC Class B certified.

Trinitron monitors have a look all their own, one that defies quantification. If you do desktop publishing, you'll probably love this Sony. For other applications, you may prefer a bigger screen that gives equal light to vertical and horizontal lines.

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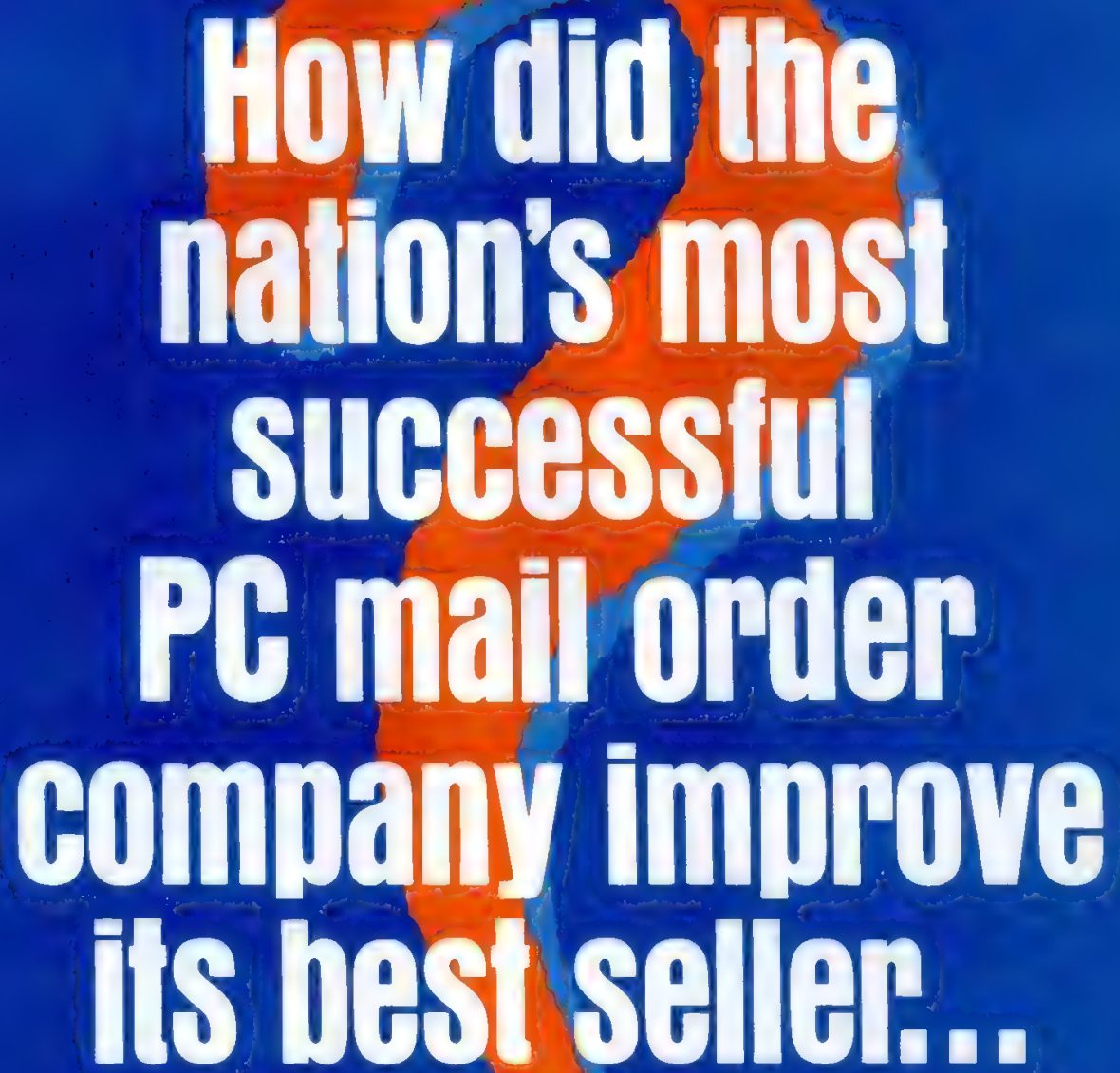
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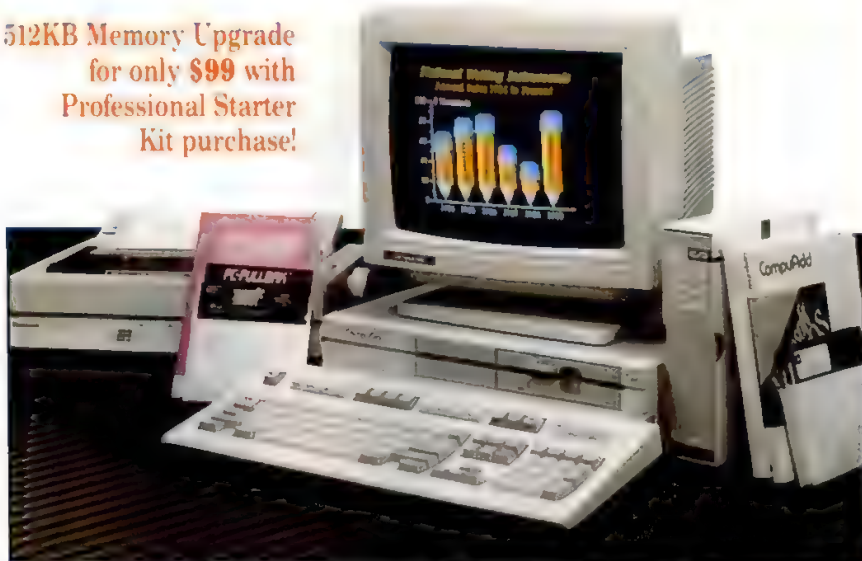
SX Success Kit Monitor And Printer Options

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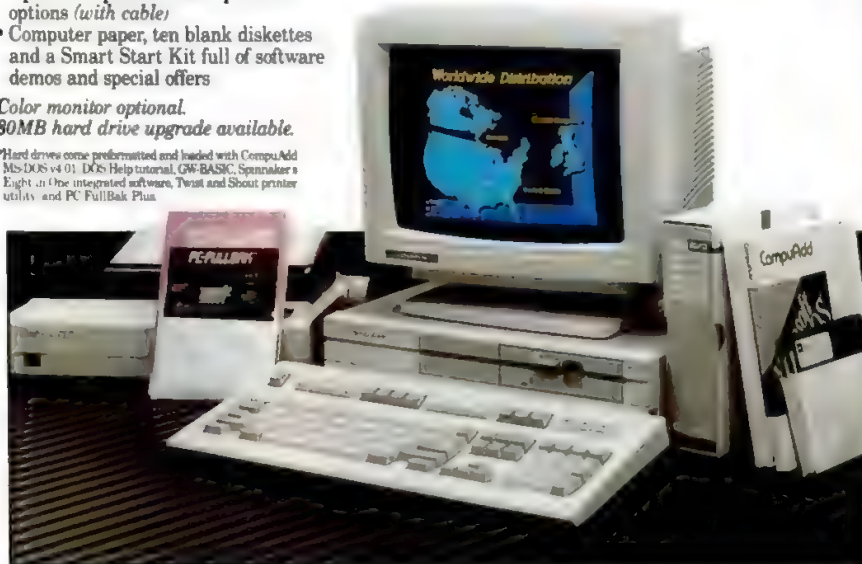
*Hard drives come preformatted and loaded with CompuAdd MS-DOS v4.01, DOS Help tutorial, GW-BASIC, Spinnaker's Eight-in-One integrated software, Twist and Shout printer utility and PC FullBak Plus.

Professional Starter Kit Monitor And Printer Options

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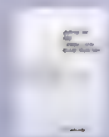
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1024

GRAPHICS ADAPTERS



They may not be as sexy
as color monitors, but
graphics adapters are
just as important when it
comes to putting
together a high-
resolution display
system.

Nearly two years ago, when *PC Magazine* published a roundup of nine low-cost VGA graphics adapters, you might have guessed that the dramatic color capabilities and high resolution of these little video wonders would represent the ultimate in mainstream graphical displays. You might have assumed that resolutions higher than VGA's crystal-clear 640 by 480 pixels would remain the province of a few high-tech designers, engineers, and architects for some time to come.

But times have changed. VGA has become the standard for business applications, and 1,024 by 768 has become the new high resolution for today's CAD and desktop publishing users.

Although less glamorous than the spectacular 1,024-by-768 monitors also reviewed in this issue, graphics adapters play a crucial role in high-resolution display systems. On the following pages, we examine 18 of these powerful adapters, priced from roughly \$400 to \$4,000.

SELECTION CRITERIA

To make it into this story, the adapters had to be single-monitor systems capable of noninterlaced color output, with VGA available in one of three ways: on-board, via a daughtercard, or from a pass-through

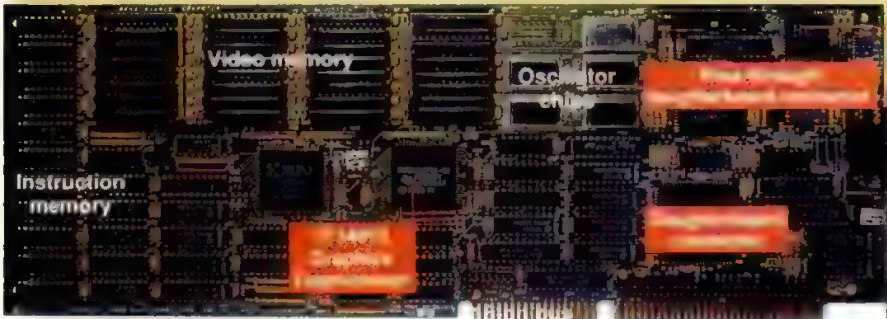
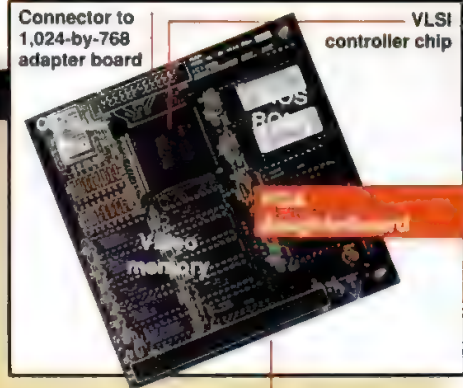
by Stuart Greenberg
and Wiley J. Reilly

ANATOMY OF A 1,024-BY-768 GRAPHICS ADAPTER

Not all 1,024-by-768 graphics adapters look alike. The 18 noninterlaced boards PC Labs tested were representative of the possible choices. Adapters can be either single boards with both high-resolution and VGA capabilities, boards that can accept a daughtercard to handle VGA mode, or boards accepting a VGA pass-through signal. You'll have to explore the pros and cons of all these methods to decide which is best for you, keeping in mind the slots available in your

PC and the capability of your existing VGA card. (Note that we're assuming you want VGA mode in addition to 1,024 mode. Users of CAD-only workstations, for example, might opt for a 1,024-only card.)

Renaissance GRX's **Rendition II** board, lauded by our reviewers, is a full-length card/daughter-board combination for those wanting both 1,024 and VGA modes. It also accepts a VGA signal on a pass-through basis. Powered by the TI 34010 chip, it has both video and instruction memory.



Digital-to-analog connector
Connector to 1,024-by-768 adapter board

15-pin analog connector

cable to your existing VGA card. Graphics adapters not included here either didn't meet our criteria, didn't arrive at PC Labs in time for testing, or didn't appear on the market in time; among these were products from Performix and Hercules.

As with the monitors reviewed in this issue, one aspect of our selection criteria was support for noninterlaced 1,024-by-768 resolution. This decision was made for the sake of your eyes. Interlaced images can be an invitation to eyestrain because they seem to flicker, particularly when you are not directly in front of the monitor. Because noninterlaced displays scan the entire image twice as quickly, without skipping lines in each pass, they yield a more stable and flicker-free picture.

ADVANTAGE 1,024

Among the many advantages of the graphics adapters reviewed here is their ability to display both standard and high-resolution text and images on a single multiscanning or multifrequency monitor, thus saving you the expense of a second monitor. The alternative—buying separate monitors—gives you somewhat more versatility. Some programs, for example, can devote one screen strictly to graphics and the other to text-based control, but at a high cost in dollars and desk space. And most single-monitor systems don't preclude adding a second monitor later on.

Single-monitor graphics adapters either

combine their high-resolution abilities with an on-board VGA chip set or else connect directly to your existing VGA board through its expansion connectors. When not operating in high-resolution mode, the high-resolution graphics adapter passes VGA signals to your monitor from the VGA board.

Some products—Renaissance GRX's **Rendition II** and its Compaq and Dell derivatives—also let you add VGA capabilities with a daughtercard. That card may save a slot, but may not be the lowest-cost solution. The Renaissance daughtercard's \$300 price tag is higher than the price of some basic VGA boards.

TWO-CLASS SYSTEM

High-resolution graphics adapters fall into two distinct classes: direct-access and coprocessor boards. All classic PC display adapters are of the direct-access breed. Their on-board video memory is mapped into the address space of your PC's CPU. Coprocessor boards work as isolated subsystems that communicate with your CPU. The most important difference between the two is performance speed. Coprocessor boards are inevitably faster on high-resolution display tasks—6 to 60 times as fast on some PC Labs tests.

Graphics coprocessors, such as the Texas Instruments TMS34010 and the Hitachi HD63484 ACRTC, have special instruction sets and register arrangements

optimized for handling display data. Therefore, a graphics coprocessor handles display manipulations faster than most general-purpose microprocessors, including the 80386 and 80486.

Ordinary display adapters work fastest when accessing your system's CPU to calculate each dot that will appear on the screen and push it into your system's memory. The high-level languages that a graphics coprocessor uses let your PC's CPU send out compact commands, such as "draw a circle" or "fill an area." Issuing a command to a graphics coprocessor involves transferring only a few bytes compared with the millions required by direct-memory access, making communications within your computer much quicker.

DRIVERS' SEAT

A graphics adapter's performance for high-resolution images also depends on the quality of its drivers. For example, Renaissance GRX and Dell Computer Corp. supply nearly identical hardware, but the performance of their products differs because each company supplies its own software drivers. Renaissance GRX's adapter is faster; its drivers are faster.

Graphics adapters with coprocessors can also earn extra speed from display-list processing, and all the adapters we reviewed do. (Alone among the direct-access boards, Personal Computer Graphics Corp.'s PCG Photon Performa also comes with display-list processing. Headland Technology's Video Seven VRAM VGA should offer a display-list driver by the time this issue goes to press.)

The benefits of a display list are like the benefits of caching; the display list allows the graphics board to regenerate a drawing

without recalculating every pixel. Besides simple screen regenerations, zoom and pan functions in CAD programs benefit most from display-list processing.

WIDER RAINBOWS

The color capabilities of a graphics adapter are measured in two ways: by the maximum palette—the range of colors that on-screen pixels can assume—and by the number of colors that can be simultaneously displayed.

A given number of bits is assigned to code the color of each pixel. A 1-bit code can specify one of two states, indicating whether a pixel is on or off. The potential is multiplied exponentially: 2 bits can specify 4 colors; 8 bits, 256 colors. Thus, memory is what limits the number of colors a graphics adapter can store. For a 1,024-by-768-pixel image in 256 colors, a graphics adapter needs at least 786,432 bytes of video memory.

That's a lot of bytes and not much color. If a display system were limited to 256 predefined colors, realistic photo-quality images would require an enormous amount of memory.

To broaden their color ranges without

1024 GRAPHICS ADAPTERS

The subtle variations
that wide palettes
allow can create
realistic images.

demanding more memory, graphics adapters use color look-up tables. Instead of defining a specific, memory-intensive color, the board's video memory stores color codes. Each code is matched to any one of the much wider assortment of colors that makes up the adapter's palette.

The results can be dramatic. Some high-resolution graphics adapters (Artist Graphics' Artist XJ10, Number Nine Computer Corp.'s Pepper Pro 1024, Vermont Microsystems' Cobra Plus/HS, and the previously mentioned Rendition II) offer palettes as wide as 16.7 million colors. The subtle variations that such wide pal-

ettes allow can create realistic images, even though only 256 different colors can be displayed on-screen at a time.

CHOOSE YOUR ADAPTER

These excellent high-resolution graphics adapters don't relegate the VGA system to the video graveyard. Instead, they cooperate with VGA, using that standard for ordinary programs and their special powers for high-resolution images. Hook a system together and be certain that all of your software shows its true colors.

ARTIST GRAPHICS

Artist XJ10

Artist Graphics bills its Artist XJ10 as a unique modular adapter, but this adapter's real strength is its extensive software support and documentation.

The Artist XJ10 starts as a basic \$2,695, full-length, AT-height standalone board that requires another video adapter for booting up your PC. By itself, this card can display 1,024 by 768 pixels, noninter-

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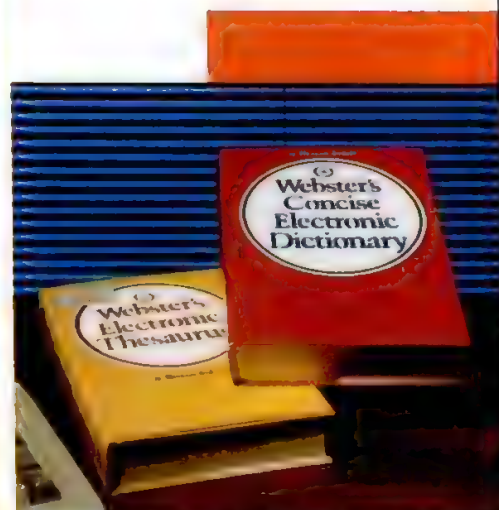
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COVER STORY 1024 GRAPHICS ADAPTERS

laced, with up to 16 simultaneous colors from a palette of 4,096. Note that, according to Artist Graphics, our test board was actually a 4-bit version, and that later 8-bit versions will support a larger color palette. The adapter can also produce 800 by 600 pixels, noninterlaced, and 1,024-by-1,024 interlaced images.

Add an optional \$700 color module with 512K of video RAM, and the palette

increases to 16.7 million colors and simultaneous hues to 256. In addition, you can plug either a VGA-compatible (\$695) or CGA-compatible (\$295—but why bother?) daughtercard into the Artist XJ10 to give your PC a single-slot video system.

Based on a Hitachi HD63484 ACRTC (Advanced CRT Controller) coprocessor, the Artist XJ10 also packs 512K of instruction memory. Although fast on some tasks, it proved very laggardly when drawing lines in *Microsoft Windows*.

While the Artist XJ10 takes advantage of 16-bit interfaces, it will work in 8-bit slots. Your monitor will also need to have BNC input connectors. The 9-pin output connector on the adapter attaches to a 6-foot BNC cable that Artist Graphics supplies with the board.

To install the Artist XJ10, you must specify a particular monitor in a special initialization file, and you must load that file every time you use the system. The file optimizes the adapter's scanning frequency for your display; its highest horizontal scanning frequency is an even 50 KHz. Although this installation is complex, it's

made manageable by a menu-driven procedure and good documentation.

The adapter's software support is excellent—it will work with a wide selection of applications (some 200, not counting the thousands you can run under *Microsoft Windows/286* or *Windows/386*). Its ADI documentation shows Artist Graphics' dedication to support—two pamphlets detail everything you need to know, and more. Such commendable support is the best reason for putting the Artist XJ10 to work in your system.

CARDINAL TECHNOLOGIES INC. Cardinal VGA600

As close to a universal video board as you can get, Cardinal Technologies' VGA600 will operate in virtually any video mode with any standard PC monitor, from TTL monochrome to high-performance analog multiscanning. An exception is IBM's 8514 standard, for which the VGA600 has neither hardware nor software support.

The VGA600, priced at \$389 with



FACT FILE

Artist XJ10

Artist Graphics, 2675 Patton Rd., P.O. Box 64750, St. Paul, MN 55164; (800) 627-8478, (612) 631-7800.

List Price: \$2,695; VGA daughtercard, \$595.

Requires: CGA or VGA monitor (depending on daughtercard purchased), or high-resolution monitor for 1,024-by-768 output

In Short: A pass-through coprocessor graphics board based on the Hitachi HD63484 chip. It offers 1,024-by-768 resolution in 256 colors from a palette of 16.7 million (when equipped with \$700 memory expansion). This board offers superior software support—over 200 applications, not to mention those you can run under *Microsoft Windows*—and fine documentation.

CIRCLE 602 ON READER SERVICE CARD



FACT FILE

EDITOR'S CHOICE

Cardinal VGA600

Cardinal Technologies Inc., 1827 Freedom Rd., Lancaster, PA 17601; (800) 233-0187, (717) 293-3000

List Price: \$389

Requires: CGA-or-better monitor for standard video modes, or high-resolution monitor for 1,024-by-768 output.

In Short: A low-cost, direct-access VGA board built around the Chips and Technologies VGA chip set that offers excellent hardware and software VGA compatibility; capable of displaying 16 colors simultaneously from a 256K palette in high-resolution mode. It demonstrated slight problems running under *Microsoft Windows*, producing a trace of snow and sluggish, jumpy mouse performance.

CIRCLE 603 ON READER SERVICE CARD

and software VGA compatibility. It had problems under *Microsoft Windows*, however, producing a trace of snow and sluggish, jumpy mouse performance.

The VGA600 offers both digital and analog signals at its rear-panel 9- and 15-pin connectors. The adapter supports full 16-bit transfers but can be automatically or manually configured to match an 8-bit interface. Installation involves setting a bank of DIP switches on the rear panel and three on-board jumpers, chiefly to specify the type of monitor that you want to use and the bus width the adapter must use. Although you can use any monitor with the VGA600, you'll need an analog multi-scanning display capable of handling a horizontal frequency of 48 KHz to get its highest resolution.

Cardinal includes a great deal of software support—three disks with drivers for the usual programs and environments, as well as OS/2 Presentation Manager. A program, VMODE, changes the VGA600's emulations, and another alters text-mode columns and rows. The separate software manual is well done, but the

hardware documentation isn't. The best part of the VGA600, though, is its price; it's an excellent value among direct-access graphics adapters.

COMPAQ COMPUTER CORP.

Advanced
Graphics 1024

Compaq Computer Corp. doesn't develop new high-resolution graphics standards, but the company is quick to adopt the best of what's available. At the 1,024-by-768 level, that means using a Renaissance GRX product similar to but not the same as the Rendition II, as the foundation of its \$1,499 Advanced Graphics 1024 board.

Based on the Texas Instruments TMS34010 coprocessor, the \$1,499 adapter holds a base of 512K (1MB with a daughtercard) of fast video memory and 512K of instruction memory. The full-length, AT-height adapter works in conjunction with another VGA board, linking up through a short card-top cable that

512K, will put up to 16 colors from a 256K palette onto a 1,024-by-768-pixel screen. In text modes, you can put up to 50 rows of 132 columns on color or monochrome screens. In addition, the adapter will attempt to put the signals of any software standard on any screen.

The 8-inch-long card is built around a Chips and Technologies VGA chip set and BIOS, and it delivers excellent hardware

Recently, the finest names in networking were put to the test.



FACT FILE

Advanced Graphics 1024

Compaq Computer Corp., 20555 SH 249, Houston, TX 77070; (800) 231-0900, (713) 370-0670.

List Price: \$1,499.

Requires: VGA or high-resolution monitor for 1,024-by-768 output.

In Short: This pass-through coprocessor board is based on the Renaissance GRX line and uses the TMS34010 coprocessor. It's a snap to install and use in a Compaq machine, but trickier in non-Compaq clones. It includes drivers only for AutoCAD, Microsoft Windows/286, and Microsoft Windows/386, but includes Compaq screen fonts for Windows that were among the sharpest we saw.

CIRCLE 904 ON READER SERVICE CARD

might stretch as far as two slots.

Equipped with three 8-bit DAC channels, the Compaq adapter has a potential palette of 16.7 million colors. With base memory, it can display 16 colors simultaneously, and 256 with its full VRAM quota. Besides high-resolution mode, the Compaq displays but one other mode—an enhanced 640-by-480 screen. No enhanced text modes are supported.

If you use Compaq products, installa-

1024 GRAPHICS ADAPTERS

tion should prove straightforward. With a non-Compaq monitor, however, you'll have to enter a parameter in your CONFIG.SYS to override the adapter's automatic monitor sensing and tell it to operate in its high-resolution mode. During *Microsoft Windows*' installation, you'll also need to indicate whether to use one of Compaq's system fonts; we encountered a few anomalies in testing when we didn't use Compaq fonts. Note that in its 1,024-by-768 mode the Compaq adapter requires a monitor capable of a horizontal synchronizing frequency of at least 54 KHz.

Only three drivers were supplied with the Compaq: *AutoCAD*, *Microsoft Windows/286*, and *Windows/386*. With the Compaq fonts, the *Windows* images were wonderfully clear, sharp, and stable. *AutoCAD* and *Windows* displays proved fast, usually comparable with the Rendition II's performance.

We'd choose the Advanced Graphics 1024 board to keep an all-Compaq system all-Compaq. Otherwise, a Renaissance original (\$2,395) is the more versatile, easier-to-install choice.

DELL COMPUTER CORP.

Dell GPX-1024/256

Once IBM introduced its 8514/A, any "real" computer company needed its own high-resolution display adapter. Consequently, Dell Computer Corp. introduced its GPX-1024 series and did IBM at least one better, going noninterlaced at the 1,024-by-768 level. Besides supporting IBM's Application Interface, Dell also adds in the speed of a Texas Instruments TMS34010 graphics coprocessor.

Physically, the GPX-1024/256 is a Rendition II from Renaissance GRX, but Dell's adapter comes with its own software and a better price. Its \$1,099 base configuration includes 128K of instruction memory and 512K of display memory. Instruction memory can be increased to 512K in 128K increments, and display memory to 768K or 1,024K. A fully equipped adapter costs \$1,498, which is nearly \$900 less than the list price of a similarly equipped Renaissance adapter. Remember, though, that Dell deals direct, and the Rendition II's price may be significantly discounted.

In LAN Magazine's famous Drag Race, over forty LANs ran flat out in a contest of speed

COVER STORY 1024 GRAPHICS ADAPTERS

Also, Renaissance's product comes with faster drivers, which may give you an incentive to spend a bit more.

Going from minimum display memory to maximum increases the number of simultaneous colors the GPX-1024 can handle at its highest resolution from 16 to 256. At any memory level, a palette of 16.7 million colors is available. Besides its highest-resolution mode (which requires a monitor able to handle a 48.8-KHz. horizontal frequency), the GPX-1024 can display images at 640 by 480, 800 by 600, and 960 by 720 pixels.

A pass-through board, the GPX-1024/256 works in conjunction with a separate VGA adapter or with its own \$199 VGA add-on daughtercard to make a single-monitor system. It can also be used with an MDA, Hercules, CGA, EGA, or VGA board in two-monitor installations. A full-size AT expansion board, it uses a 16-bit interface but also works in 8-bit slots.

Hardware installation proved to be simple, but software installation was complicated by an automatic procedure that was designed solely to accommodate Dell products; matching the GPX-1024/256 to

your system means choosing from a menu of Dell CPU and monitor models. We faked it, choosing the nearest Dell equivalent to our test system, and got excellent results.

A full complement of driver software is included with the GPX-1024/256, and the adapter's AI abilities extend its reach to software that follows that IBM standard. The *Symphony* driver extends spreadsheets

to up to 128 text (not cell) columns by 64 text rows. The accompanying documentation for the drivers is good; the smaller type size spares you the inconvenience of a humongous manual.

Although the Dell drivers were not as fast as those from Renaissance, the savings that the GPX-1024 offers may make it a better choice for the budget-conscious than its twin, Renaissance's Rendition II.



FACT FILE

Dell GPX-1024/256

Dell Computer Corp., 9505 Arboretum Blvd., Austin, TX 78759-7299; (800) 426-5150.

List Price: \$1,498.

Requires: VGA monitor, or high-resolution monitor for 1,024-by-768 output.

In Short: Based on the Renaissance Rendition II, this is a pass-through or standalone coprocessor graphics adapter that uses the TMS34010 chip. And while it is less expensive than the Rendition II, Dell deals direct and offers no dealer discounts. The Renaissance adapter may be available at a substantial discount, and features newer, faster drivers.

CIRCLE 606 ON READER SERVICE CARD

ENERTRONICS RESEARCH INC.

Aurora 1024N

Aiming to do IBM's 8514/A system one better, the Aurora 1024N, from Enertronics Research, goes a lot further. While the basic \$995 adapter duplicates the IBM product's interlaced 1,024-by-768 resolution with 256 simultaneous colors from a palette of 256K, an additional \$300 will buy a flicker-free, noninterlaced version. Add to that faster performance courtesy of a 40-MHz TMS34010 video coprocessor, and you have an intriguing display system.

Although the Aurora is not hardware-

and endurance.

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AT&T
Computer Systems

CIRCLE 135 ON READER SERVICE CARD



FACT FILE

Aurora 1024N

Enertronics Research Inc., 1910 Pine St., St. Louis, MO 63103; (800) 325-0174, (314) 421-2771.

List Price: \$1,295; with VGA capability, \$1,500.

Requires: 8514-style monitor or higher-resolution monitor for 1,024-by-768 output

In Short: A pass-through coprocessor board with 1MB of video memory. It's compatible with IBM's 8514/A AI standard but produces high-resolution images in 256 colors from a 256K palette. Setup problems, as well as some unexplained color changes when exiting from *AutoCAD*, make this one tricky to install and use.

CIRCLE 606 ON READER SERVICE CARD

compatible with the 8514/A standard, it does understand Application Interface commands. Unlike the official IBM adapter, however, the base-model Aurora has no innate VGA abilities; you'll need a VGA card or an upgrade from Aurora that incorporates them. Besides its high-resolution graphics mode, the Aurora also works at 640 by 480 pixels. It features no high-resolution text modes.

The full-length, AT-height adapter incorporates 1MB of video memory. It couples to your system through an 8-bit bus connector. It links itself and whatever VGA board you use with it to your monitor through a standard VGA-style, high-density, 15-pin connector. A ribbon cable long enough to span four slots is included to couple it to your VGA adapter.

Plugging the Aurora into your system is no problem, but getting it to work can be. There are two programs that must be run in order to set up the adapter each time you use it. Putting them into your AUTOEXEC.BAT file creates a problem: on a machine as fast as the Compaq 386/25 that we used for testing, the Aurora doesn't reset fast enough to accept the second program back-to-back with the first. We had to install a Pause in our AUTOEXEC.BAT file to boot up with the board.

We encountered one additional problem that Enertronics could not explain: display color was unpredictable when returning to text mode from *AutoCAD*. Sometimes the screen background was red, sometimes blue, and so on.

The Aurora will work with any program that recognizes the IBM AI interface. In addition, it includes its own *AutoCAD* and *Microsoft Windows/286* drivers. No *Windows/386* driver is currently available. Under *AutoCAD*, you'll need at least 2MB of EMS memory to use the Aurora's dis-

COVER STORY

1024 GRAPHICS ADAPTERS

play-list processing abilities.

The Aurora 1024N offers full AI support in a classic AT-bus computer. While the Aurora was first to offer this support, other adapters now have the same capability with fewer bothersome bugs.

GENOA SYSTEMS CORP.

SuperVGA 6400

If you're willing to sacrifice a bit of speed to get top VGA compatibility in a high-resolution graphics adapter, consider Genoa Systems Corp.'s SuperVGA 6400. Based on Genoa's own ASIC (Application-Specific Integrated Circuit) chip and an Award VGA BIOS, the 6400 achieved a perfect score on the PC Labs VGA Hardware Compatibility test—no mean feat. At \$399 with 512K video RAM, the 6400 is the lowest-priced adapter to offer such flawless abilities.

With only analog outputs, the 6400 connects to standard VGA monitors as well as multiscanning displays. With the latter, it will deliver resolutions of up to 1,024 by 768 pixels in up to 16 colors from a palette of 256K.

Built-in emulations make the Genoa adapters software-compatible with every IBM standard in existence, from MDA up to 8514/A and everything in between, including Hercules graphics. In text mode, the adapters will put as many as 132 columns by 60 rows on-screen in color or monochrome. The boards also feature an optional 70-Hz frame rate for 640-by-480 VGA signals, which reduces apparent screen flicker.

Setting up the 8-inch-long Genoa adapter means nothing more than flipping

a bank of eight DIP switches that are accessible through the retaining bracket of the board. The most important of these settings matches the adapter to your fixed-frequency VGA display or multisync monitor. The Genoa adapters automatically configure themselves for 8- or 16-bit expansion slots (the BIOS also automatically adapts to the bus width). Automatic bus-width setting can be overridden by a DIP-switch setting. The BIOS can be relocated into RAM.

Genoa includes all the normal high-resolution drivers, including *Microsoft Windows/386*, with SuperVGA adapters. Specialized CAD drivers for *CADvance*, *MicroStation PC*, *PCAD*, and *VersaCAD* are available from Genoa at \$25 for the set of four. Genoa also packages several clever utilities with the SuperVGA products, including a smooth-scrolling utility and tuning program that matches CPU and video timing to improve board performance. We noticed no performance difference in *Windows*, however.

VGA perfection, AI support, and low price combine to make the SuperVGA 6400 a top choice among direct-access high-resolution graphics adapters.

HEADLAND TECHNOLOGY INC.

Video Seven
VRAM VGA

One of the most popular VGA adapters on the market, Headland Technology Inc.'s Video Seven VRAM VGA earned its enviable position simply by being fast. The \$747 board brings together two technologies—a 16-bit interface and quick, dual-ported video memory—to create one of the fastest direct-access VGA display adapters available.

Hardly incidentally, the VRAM extends display resolution to 1,024 by 768 pixels, noninterlaced, with 16 simultaneous colors drawn from a palette of 256K. In resolutions of 800 by 600 and lower, it can display as many as 256 simultaneous colors from the same palette, assuming you've installed the VRAM's full complement of 512K of 120-nanosecond memory.

A low-height, full-length board, the VRAM VGA fits the IBM PS/2 form factor but works in PCs and ATs. It's an analog-only board with but one 15-pin high-



FACT FILE

SuperVGA 6400

Genoa Systems Corp., 75 E. Trimble Rd., San Jose, CA 95131; (408) 432-9090.

List Price: \$399.

Requires: VGA monitor for standard video modes up to VGA, or high-resolution monitor for 1,024-by-768 output.

In Short: A direct-access VGA board that handles every video mode you can pitch its way. An easy installation, it comes with a variety of excellent drivers and utilities, and more are available at a bargain-basement price.

CIRCLE 607 ON READER SERVICE CARD



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Model	Description	Resolution	Maximum Resolution
1410 Plus	14" 0.51	CGA	640 x 200
1420 Plus	14" 0.39	EGA	640 x 350
1425 Plus	14" 0.39	VGA	640 x 480
1430 Plus	14" 0.31	VGA	640 x 480
1450 Plus	14" 0.31	VGA/SuperVGA	800 x 600
1480 Plus	14" 0.28	VGA/SuperVGA/8514A	1024 x 768*
1610 Plus	16" 0.31	VGA/SuperVGA/8514A	1024 x 768*

*Interlaced Mode

The Plus family works with all IBM® PCs. The 1450 Plus works with both IBM and Apple® Mac II®.



GoldStar

CIRCLE 233 ON READER SERVICE CARD

COVER STORY

1024 GRAPHICS ADAPTERS



NONINTERLACED 1,024-BY-768 GRAPHICS ADAPTERS: SUMMARY OF FEATURES

Products listed in ascending price order

The 18 1,024-by-768 noninterlaced graphics adapters in this roundup work in a variety of ways. Half use a high-speed graphics coprocessor, and half access your computer's CPU directly.

Adapters with coprocessors are faster because they perform complex image calculations that would otherwise tax your CPU. But these adapters cost a lot more than the direct-access boards. To produce images in VGA mode, all but two of the adapters with

	Cardinal Technologies Inc. Cardinal VGA600	Genoa Systems Corp. Super VGA 6400	Samsung Information Systems America Inc. Samsung SVGA16	STB Systems Inc. STB VGA EM-16	Orchid Technology ProDesigner Plus	Tecmar Tecmar VGA/AD	Personal Computer Graphics Corp. PCG Photon Performa	Trident Microsystems Inc. Trident 8916
List price	\$389	\$399	\$399	\$469	\$499	\$580	\$595	\$595
BUS TYPE								
ISA 8-bit	■	■	■	■	■	■	■	■
ISA 16-bit	■	■	■	■	■	■	■	■
MCA	□	□	□	□	□	□	□	□
EISA	□	□	□	□	□	□	■	□
PHYSICAL CHARACTERISTICS								
Board size (inches):								
Length	8	8	9.75	8.5	13.25	11	8	8.5
Height	4.25	4.25	4	4	3	4	4.5	4.25
Thickness	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.75
HIGH-RESOLUTION CHARACTERISTICS								
High-resolution graphics coprocessor	None	None	None	None	None	None	PCG	None
High-resolution memory	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	512K	N/A
VGA CHARACTERISTICS								
VGA and high resolution on the same card	■	■	■	■	■	■	■	■
Accepts VGA daughtercard	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*
Accepts VGA pass-through	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*
Pass-through cable included	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*	N/A*
VGA BIOS ROM manufacturer	Cardinal	Genoa	Tseng Laboratories	STB/Award	Tseng Laboratories	Tecmar	PCG	Trident
Version number	1.5	2.2	8.00	1.02	2.2	1.10A	2.2A	1
Revision date	1989	1989	1989	1989	1989	1989	1989	1990
VGA graphics processor	Chips and Technologies	Genoa	Tseng Laboratories	Tseng Laboratories	Tseng Laboratories	Tseng Laboratories	PCG	Trident
VGA memory	512K	512K	256K	512K	512K	512K	1MB	1MB
MAXIMUM RESOLUTION								
Graphics (pixels):								
Maximum addressable pixels	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768	1,440 x 720	1,024 x 768	1,024 x 768
Maximum visible pixels	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768	1,440 x 720	1,024 x 768	1,024 x 768
Text (columns x rows)	132 x 50	132 x 60	132 x 44	133 x 44	132 x 44	132 x 60	132 x 25	132 x 60
Number of colors in 1,024 x 768 mode:								
Palette	262,144	262,144	262,144	262,144	262,144	262,144	262,144	16,777,220
Maximum simultaneously displayable	16	16	16	16	16	16	16	256
VIDEO STANDARDS								
CGA	■	■	■	■	■	■	■	■
MDA	■	■	■	■	■	■	■	■
Hercules	■	■	■	■	■	■	■	■
EGA	■	■	■	■	■	■	■	■
VGA	■	■	■	■	■	■	■	■
Super VGA (800 x 600)	■	■	■	■	■	■	■	■
1,024 x 768	■	■	■	■	■	■	■	■
8514/A	□	■	□	□	□	□	□	□

■—Editor's Choice ■—Yes □—No

N/A*—Not applicable: this graphics adapter has no coprocessor and therefore uses system memory rather than high-resolution memory.

N/A*—Not applicable: this graphics adapter has VGA on-board and does not need a VGA daughtercard or pass-through cable.

COVER STORY

1024 GRAPHICS ADAPTERS

coprocessors require either a VGA daughtercard or a standard VGA adapter (connected to the high-resolution board with a pass-through cable). Although the direct-access adapters are slower, they include built-in VGA capability.

Of course, when you are choosing a graphics adapter, the most important feature to look for is support for your applications.

Headland Technology Inc. Video Seven VRAM VGA \$747	Dell Computer Corp. Dell GPX-1024/256 \$899	Enertronics Research Inc. Aurora 1024N \$1,295	Compaq Computer Corp. Advanced Graphics 1024 \$1,499	Number Nine Computer Corp. Pepper Pro 1024 \$1,995	NEC Technologies Inc. NEC MultiSync Graphics Engine \$1,999	Matrox Electronic Systems Ltd. Matrox PG-1024V \$2,395	Renaissance GRX Inc. Rendition II \$2,395	Artist Graphics Artist XJ10 \$2,695	Vermont Microsystems Inc. Cobra Plus/HS \$3,395
■	■	■	■	■	□	□	■	■	■
■	■	■	■	■	■	■	■	■	■
□	□	□	□	■	■	□	□	□	□
□	□	□	□	□	□	□	□	□	□
13.5	13.5	13.25	13.5	13.25	13.25	13.25	13.25	13.25	13.5
3	4.5	4.5	4.5	4	4.5	4.5	4.5	4.5	4.5
0.5	0.75	0.5	0.5	0.5	0.5	0.75	0.75	0.75	0.5
None	Texas Instruments 1MB	Texas Instruments 1MB	Texas Instruments 1MB	Texas Instruments 1MB	Texas Instruments 1MB	Texas Instruments 512K	Texas Instruments 1MB	Hitachi 1MB	Texas Instruments 1.5MB
N/A*	■	□	□	□	■	□	□	□	□
N/A*	■	□	□	□	N/A*	□	■	■	□
N/A*	■	■	■	■	N/A*	■	■	■	■
N/A*	■	■	■	■	N/A*	■	■	□	■
Video Seven	Renaissance	Cirrus Logic/ Award	Compaq	N/A	Chips and Technologies	N/A	Renaissance	Cirrus Logic/ Award	Video Seven
1.1	1.02	2.12	D	N/A	1.1.1n	N/A	1.03	2.19H	1.09
1989	1989	1988	1987	N/A	1988	N/A	1989	1989	1988
Video Seven	Renaissance	Cirrus Logic	Paradise	N/A	Chips and Technologies	N/A	Renaissance	Cirrus Logic	Video Seven
512K	256K	256K	256K	N/A	256K	N/A	256K	256K	512K
1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768	4,096 x 2,048	1,024 x 768	1,024 x 1,024	1,024 x 768	1,024 x 768	1,024 x 768
1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768
132 x 43	132 x 40	146 x 51	N/A	150 x 50	132 x 60	N/A	128 x 64	N/A	N/A
262,144	16,777,220	262,144	16,777,220	16,777,220	16,777,220	4,096	16,777,220	16,777,220	16,777,220
16	16	256	16	256	256	16	256	256	256
■	□	■	□	□	■	■	□	■	□
■	□	■	□	□	■	□	□	■	□
■	□	■	□	□	■	□	□	■	□
■	□	■	□	□	■	□	□	■	□
■	■	■	■	■	■	□	■	■	■
■	■	■	■	■	■	□	■	■	■
■	■	■	■	■	■	■	■	■	■
□	■	■	□	□	■	□	■	□	■

CONTINUES

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COVER STORY

1024 GRAPHICS ADAPTERS

NONINTERLACED 1,024-BY-768 GRAPHICS ADAPTERS: SUMMARY OF FEATURES



	Cardinal Technologies Inc. Cardinal VGA600	Genoa Systems Corp. Super VGA 6400	Samsung Information Systems America Inc. Samsung SVGA16	STB Systems Inc. STB VGA EM-16	Orchid Technology ProDesigner Plus	Tecmar Tecmar VGA AD	Personal Computer Graphics Corp. PCG Photon Performa	Trident Microsystems Inc. Trident 8916
OUTPUT								
TTL	■	□	■	■	□	■	■	■
Analog	■	■	■	■	■	■	■	■
Connectors:								
9-pin	■	□	■	■	□	■	■	■
9-pin to BNC	□	□	□	□	□	□	□	□
15-pin	■	■	■	■	■	■	■	■
Video cable included	□	□	□	□	□	□	□	□
SOFTWARE DRIVERS								
AutoCAD	■	■	■	■	■	■	■	■
Supports display list	□	□	□	□	■	□	■	□
GEM	■	■	■	■	■	■	■	■
Lotus 1-2-3	■	■	■	■	■	■	■	■
Presentation Manager	■	□	□	□	□	■	■	□
Ventura Publisher	■	■	■	■	■	■	■	■
Microsoft Windows/286	■	■	■	■	■	■	■	■
Microsoft Windows/386	■	■	■	■	■	□	■	■

■—Editor's Choice ■—Yes □—No

density connector on its retaining bracket. The board's critical circuitry includes a Video Seven VGA chip and an Arrow/Video Seven ROM. Although hardware-compatible only with VGA and multiscanning analog monitors, the VRAM VGA emulates all IBM display modes and Hercules graphics through software.

Installation is painless, notwithstanding a bank of DIP switches and five jumpers. At most, you'll have to flip a few switches—two to determine whether the adapter will automatically or manually select its 8- or 16-bit interfacing abilities, and another to choose the addresses used by its video memory.

Software included with the VRAM VGA ranges from the usual application

and environment drivers to a mode-changing application and even a screen-saver program.

Unfortunately, the VRAM VGA has stood still while the world has changed around it. Its VGA hardware-compatibility hasn't improved over the years, and other boards have caught up to its once-exemplary speed. Nevertheless, it's still a well-behaved adapter that offers a multitude of VGA-and-better possibilities, which have become almost a standard. It may no longer be the best choice, but the VRAM VGA is still a safe choice that will fulfill most display needs.

Each of these adapters is built around a TMS34010 graphics processor running at 50 MHz; each can be complemented by a range of both colors and memory capacities; and each of these adapters uses a 16-bit interface.

According to the company, all Matrox adapters at the 1,024-by-768 level are shipped with 512K video memory. By our count, the total was 640K, but Matrox says the additional space is used for buffering. The 20 4-by-64-Kilobit VRAM chips on the adapter give a 256K memory bonus, not to mention the 40 pads that can hold additional memory.

The simplest adapter at this resolution level comes with 512K of instruction RAM and can produce 16 colors from a



FACT FILE

Video Seven VRAM VGA

Headland Technology Inc., 46335 Landing Pkwy., Fremont, CA 94538; (415) 623-7857. List Price: \$747.

Requires: VGA monitor for standard video modes or high-resolution monitor for 1,024-by-768 output.

In Short: A direct-access, analog-only VGA graphics adapter with extended modes up to 1,024 by 768 pixels in 16 colors from a 256K palette. Once among the fastest VGA boards thanks to its full 16-bit interface and fast VRAM, other less-expensive boards have caught up with it.

CIRCLE 608 ON READER SERVICE CARD

MATROX ELECTRONIC SYSTEMS LTD.

Matrox PG-1024V

The \$2,395 PG-1024V from Matrox Electronic Systems is built like an automobile from Detroit's heyday. It's a big, solid, AT-sized adapter on which everything is optional or, if you prefer, customizable. The PG-1024V's basic platform offers you a variety of colors, palettes, and instruction memories to suit even the most-sophisticated graphics needs.

Matrox starts with a basic foundation of three maximum resolutions—640 by 480, 1,024 by 768, and 1,280 by 1,024 pixels.



FACT FILE

Matrox PG-1024V

Matrox Electronic Systems Ltd., 1055 St. Regis Blvd., Dorval, Quebec, Canada H9P2T4; (800) 361-4903.

List Price: \$2,395.

Requires: Super VGA-capable monitor or high-resolution monitor for 1,024-by-768 or higher output.

In Short: A pass-through or standalone coprocessor board that proved to be the most difficult to install. Its documentation was a chore to understand, and the board exhibited constant flicker. It included a driver for AutoCAD but not for Microsoft Windows/386.

CIRCLE 609 ON READER SERVICE CARD

[illegible]

ENDS

palette of 4,096 at a cost of \$1,995. One upgrade possibility gives you 16 colors and 1.5MB of instruction memory for \$2,395; this version was the adapter we tested. Or you can increase the color range to 256 from a palette of 16.7 million (with the base 512K DRAM) for \$2,595 total. The fully loaded version—maximum colors and memory—lists for \$2,999.

The PG-1024V is a pass-through board but has no VGA expansion connector. Instead, VGA video loops through the adapter via a 15-inch cable that runs between rear-panel connectors. Without a VGA adapter, the PG-1024V itself can boot your system in its CGA-emulation mode.

The PG-1024V was more difficult to install than any of the other graphics adapters in this review. The process became even more complicated when we consulted the instructions—they left us bewildered at best. Factory support proved mandatory.

Once the adapter was up and running, the results were less than pleasing. We noted a flicker problem on everything we ran. Although the difficulties may have resulted from the test computer being run with its cover off, only one other board exhibited similar performance in the same circumstances.

The software support was equally disappointing; few drivers were sent with the package, and support for *Microsoft Windows/386* is not available. On the other

hand, the PG-1024V was able to run *AutoCAD*, which may be the best application for this adapter and the entire Matrox graphics system.

The PG-1024V would be a good choice for a turnkey CAD system assembled by a system integrator with the time and wizardry needed to match software and monitor to the various permutations of Matrox products. Otherwise, look elsewhere.

NEC TECHNOLOGIES INC
NEC MultiSync
Graphics Engine

Designed to match (although not operate exclusively with) NEC's MultiSync line of monitors, the MultiSync Graphics Engine (or MGE) from NEC Technologies will run almost any variable-scan-rate display to the edge of its capabilities. In the \$1,499 base version, the limit is noninterlaced 1,024- by 768-pixel graphics in 16 colors drawn from a 256K palette; the \$1,999 version that we tested offers you 256 colors and is enhanced to a full megabyte of video RAM.

The MGE is a complete display system on a single, full-size AT expansion board; it is based on a TMS34010 graphics coprocessor with 512K of instruction memo-

ry and a Chips and Technologies VGA chip (and separate memory for VGA images). It handles standard VGA, Super VGA (800-by-600), and 1,024-by-768 signals, interlaced or noninterlaced. The adapter can also be used in dual-monitor systems.

The amount of active circuitry on the MGE board is immense; the board is packed with surface-mount components. Its single high-density 15-pin connector plugs into analog monitors with VGA-and-better capabilities. Super VGA operation requires a horizontal synchronizing frequency of 35.5 KHz; a resolution of 1,024 by 768 requires 48.6 KHz.

A menu-driven setup program helps modify the MGE's driver software to match particular monitor requirements (including technical details such as back porch, front porch, and sync timings).

FACT FILE

EDITOR'S CHOICE

NEC MultiSync Graphics Engine
NEC Technologies Inc., 1255 Michael Dr., Wood Dale, IL 60191; (708) 860-9500.
List Price: \$1,999.

Require: 8514 or higher-resolution monitor.
In Short: A coprocessor board with built-in VGA abilities that's programmable to accept a wide variety of monitors. Easily installed and accompanied by copious documentation, this is an excellent buy for any application.

CIRCLE #19 ON READER SERVICE CARD

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CIRCLE 350 ON READER SERVICE CARD



Model MC316S-5 MCA 80386SX 16Mhz

- Microchannel architecture fully IBM compatible
- 2 MB RAM expandable to 8 MB on CPU Board
- 1.44 MB Floppy Drive
- 101-Key Enhanced Keyboard
- MS DOS (choose 3.3 or 4.01)
- On-board VGA Controller
- Memory Management disk cache program software
- Five slots

Base system:	\$2,255
40 MB VGA mono system	\$3,087
40 MB VGA color system	\$3,417
76 MB VGA mono system	\$3,561
76 MB VGA color system	\$3,891

Model AT316S-6 80386SX 16Mhz

- Industry Standard Architecture
- 1 MB RAM expandable to 8 MB on CPU Board
- 1.2 MB or 1.44 MB Floppy Drive
- 101-Key Enhanced Keyboard
- MS DOS (choose 3.3 or 4.01)
- Integrated Floppy Controller
- Memory Management Software

Base system:	\$1,458
40 MB VGA mono system	\$2,169
40 MB VGA color system	\$2,499
100 MB VGA mono system	\$2,586
100 MB VGA color system	\$2,916

Model AT216-6 80286 16Mhz

- Industry Standard Architecture
- 1 MB RAM expandable to 8 MB on CPU Board
- 1.2 MB or 1.44 MB Floppy Drive
- 101-Key Enhanced Keyboard
- MS DOS (choose 3.3 or 4.01)
- Integrated Floppy Controller
- Memory Management Software

Base system:	\$1,263
20 MB VGA mono system	\$1,863
20 MB VGA color system	\$2,193
40 MB VGA mono system	\$1,974
40 MB VGA color system	\$2,304

* Prices and specifications subject to change. Not available outside U.S.A. Dell is a registered trademark of Dell Computer Corporation. MS DOS and Windows are reg. trademarks of Microsoft Corp. Freestyle is a reg. trademark of Wang Laboratories, Inc.

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During installation, NEC monitors can be specified by menu choices. For non-NEC displays, you'll need to enter some very technical details about waveforms and the like. You may also have to adjust two jumpers on the adapter. The documentation is thorough but complex enough to appear daunting to those not technically inclined.

The primary interface of the adapter is NEC's own Direct Graphics Interface Standard (DGIS), which installs as a terminate-and-stay-resident program. Drivers and complete installation instructions are available to link DGIS and the adapter to applications and environments including *AutoCAD*, *GEM*, *Microsoft Windows/286*, and *Windows/386*.

Overall, the NEC MultiSync Graphics Engine is powerful, versatile, and fast—it is a perfect match either for an NEC monitor or for the high-resolution monitor of your choosing.

NUMBER NINE COMPUTER CORP.

Pepper Pro 1024

The Pepper Pro 1024 is a hardware wiz waiting for its software to catch up—a problem we've seen with other adapters in this roundup. In fact, this graphics board from Number Nine Computer Corp. would be one of our favorites if it supported *Microsoft Windows/386* and Presentation Manager. Even so, the \$1,995 Pepper Pro 1024 is a quick coprocessor board that offers wonderful new features for *AutoCAD* and many other applications.

Based on a TMS34010 coprocessor operating at 60 MHz, the Pepper Pro 1024 operates at two resolution levels, 1,024 by 768 and 640 by 480. Despite the lower-

resolution mode, the Pepper is not VGA compatible, and you'll have to connect it with a standard VGA adapter. You also can't boot your computer from the Pepper—even if you are using a two-monitor system.

As standard equipment, the Pepper includes 512K of instruction memory for the TMS34010. Four sockets on the board await additional 80-nanosecond 4-by-256-kilobit chips to push instruction memory up to a maximum of 1MB. A megabyte of on-board video memory gives the Pepper a range of 256 colors drawn from a palette of 16.7 million, even in its high-resolution mode. Another mode builds a virtual screen measuring 4,096 by 2,048 pixels for fast hardware panning, although the Pepper is limited to two colors in this mode.

In its high-resolution mode, the Pepper requires a monitor with at least a 64-MHz bandwidth at a horizontal scanning frequency of 48.7 KHz. The full-length board offers only analog outputs and connects to your monitor through a 15-pin

high-density connector. It uses a single ten-bank DIP switch for setup.

Installation is a little bit more involved than it is for some graphics boards, but if you follow the several pages of instructions, you won't encounter a problem. One bothersome aspect of the documentation is its lack of information about what each switch setting means. Although the manual does indicate which settings to use in particular circumstances, it doesn't give you the information you need for more-unusual scenarios.

Nothing in the manual says what the purpose of each setting is, why it works the way it does, or how to tell whether it's working at all. But it did tell us what to do about the out-of-environment-space error that we encountered when setting up the board.

The Pepper can use either of two operating systems for applications interfacing—its own NNios (Number Nine Intelligent Operating System) or TIGA-340; the two coexist and are used by different applications. For example, *AutoCAD* uses



PERFORMANCE TESTS: 1,024-BY-768 GRAPHICS ADAPTERS

AUTOCAD PERFORMANCE TESTS

PC Labs used four test suites to measure the performance of 1,024-by-768 graphics adapters. Only the *AutoCAD* performance tests could be run on every adapter. So even if you aren't a CAD user, you'll want to take a close look at how each adapter performed under *AutoCAD*.

The **Mass Entity Regeneration** test measures the time it takes to regenerate an on-screen DXF file that represents a single entity (multiple wireframe views of a single engineering model). Timing begins when the Regen command is invoked and ends when the image has completely reappeared.

The **Mass Entity Redraw** test uses *AutoCAD*'s Redraw command to redraw the single-entity screen. This command throws the contents of a memory buffer onto the screen; the image appears faster but is less precise than when the Regen command is used. Timing begins when the command is invoked and ends when the image has completely reappeared.

The **Full-Screen Regeneration** test measures the time it takes to regenerate an on-screen DXF file containing a number of bubble-like entities. Timing begins when the Regen command is invoked and ends when the image has completely reappeared.

The **Full-Screen Redraw** test uses *AutoCAD*'s Redraw command to redraw the multiple-entity screen. Timing begins when the command is invoked and ends when the image has completely reappeared.

CONTINUES

In PC Labs' tests, each 1,024-by-768 graphics adapter was installed in a Compaq Deskpro 386/25 with an NEC MultiSync 5D 1,024-by-768 monitor. To measure performance, we used four test suites: *AutoCAD* Performance Tests; VGA Hardware Compatibility Tests; Graphics Performance Tests for *Microsoft Windows*, Version 1.0; and VGA Performance Tests (the last two are newly designed test suites). Each test measures how long it takes the adapter to perform a particular task. The only test suite that could be run on all 18 adapters was *AutoCAD* Performance.

Because all the adapters tested here run in VGA mode, we are not reporting the results of our VGA Hardware Compatibility Tests (which were pass/fail tests). The adapters that adhered most strictly to the VGA standard are the Trident 8916, SuperVGA 6400, Cardinal VGA600, and the Artist XJ10. For more information on how well the adapters did in VGA mode, turn to the VGA Performance Tests.

FACT FILE

Pepper Pro 1024

Number Nine Computer Corp., 725 Concord Ave., Cambridge, MA 02138; (617) 492-0999.
List Price: \$1,995.

Requires: VGA monitor for standard video modes, or high-resolution monitor for 1,024-by-768 output.

In Short: A fast pass-through coprocessor graphics board based on the TMS34010 chip. The Pepper Pro uses both its own proprietary NNios and TIGA-340 interfaces for excellent software support but lacks a *Windows/386* driver.

CIRCLE #11 ON READER SERVICE CARD

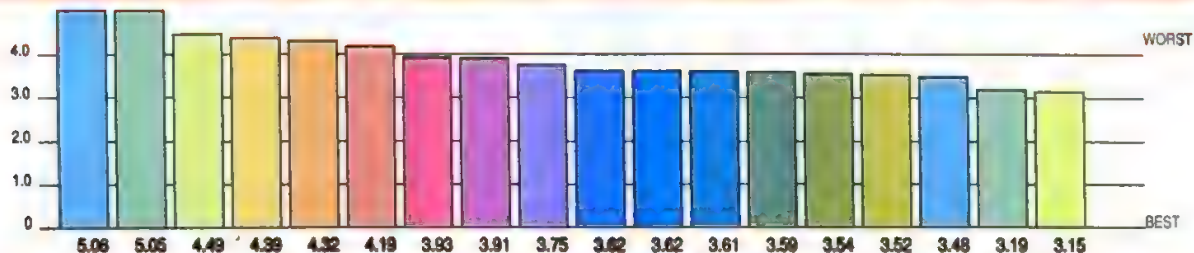


PERFORMANCE TESTS: 1,024-BY-768 GRAPHICS ADAPTERS

AUTOCAD PERFORMANCE TESTS

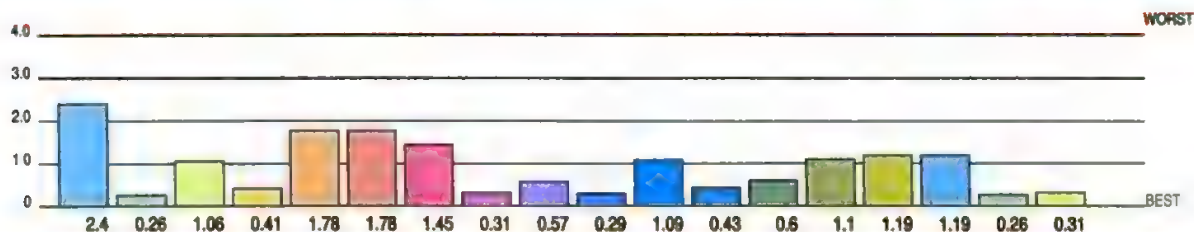
Mass Entity Regeneration

Elapsed Time (seconds)



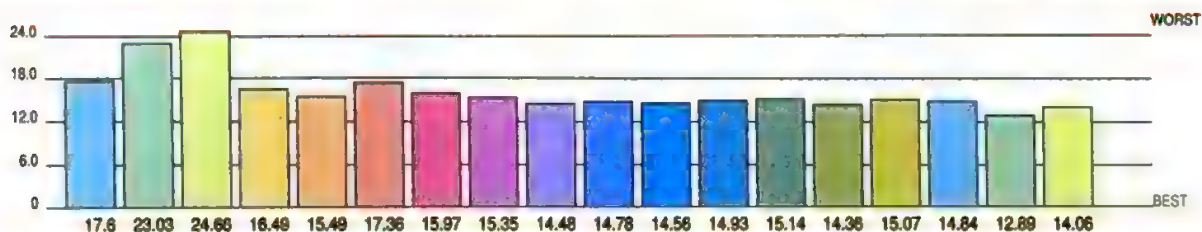
Mass Entity Redraw

Elapsed Time (seconds)



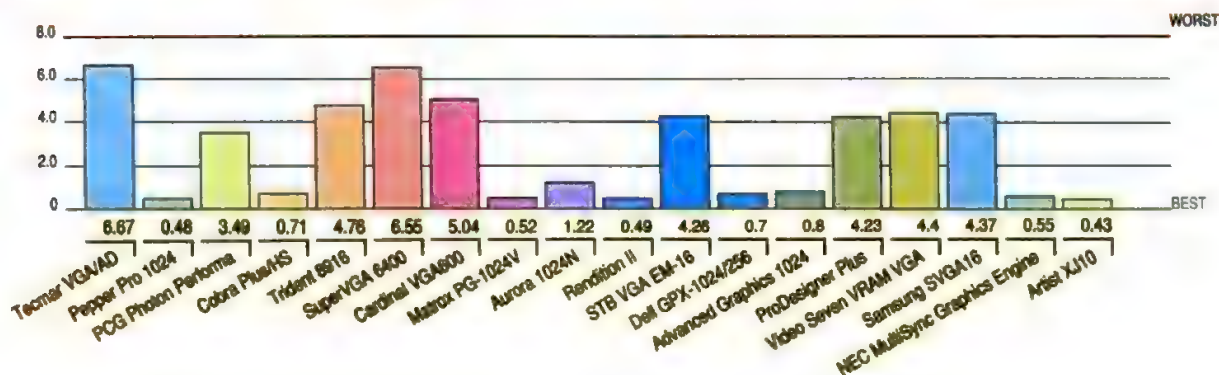
Full-Screen Regeneration

Elapsed Time (seconds)



Full-Screen Redraw

Elapsed Time (seconds)

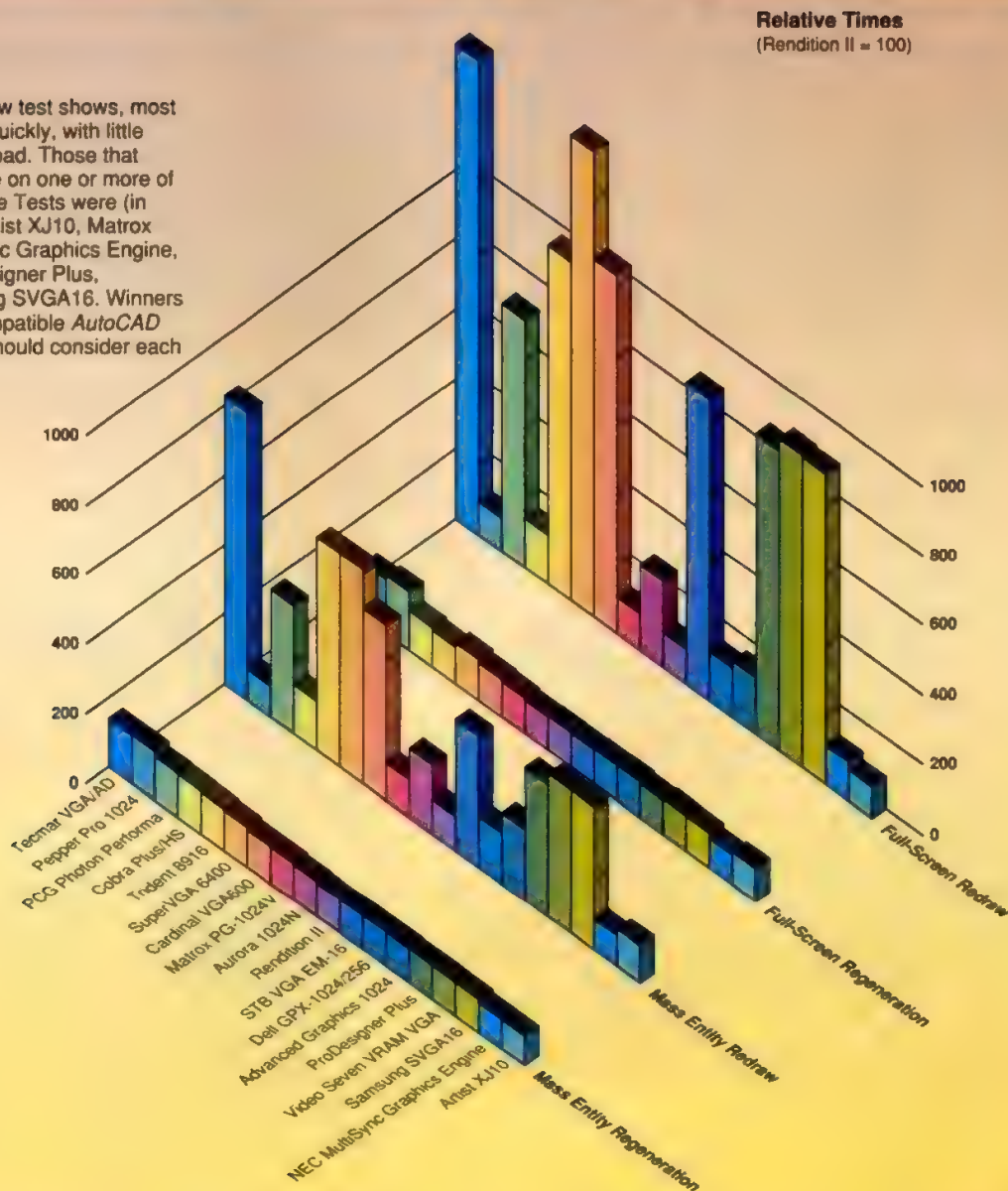


CONTINUES



AUTOCAD PERFORMANCE TESTS: COMPOSITE VIEW

As our Mass Entity Redraw test shows, most of the tested boards ran quickly, with little system processing overhead. Those that achieved top performance on one or more of the *AutoCAD* Performance Tests were (in alphabetical order) the Arist JX10, Matrox PG-1024V, NEC MultiSync Graphics Engine, Pepper Pro 1024, ProDesigner Plus, Rendition II, and Samsung SVGA16. Winners on this test have fast, compatible *AutoCAD* drivers, and CAD users should consider each one of them seriously.



ENDS

NNios; *Windows*, TIGA-340. NNios offers no 8514 support. For *AutoCAD*, the Pepper software adds a special Number Nine to elicit the board's special features, such as world view, hardware zooming, and panning. While the Pepper does support an otherwise full list of applications, it unfortunately still lacks *Windows/386* and *Presentation Manager* drivers. Overall, the Pepper Pro 1024 is a solid performer, but if you know you need these last two drivers, you'll have to look elsewhere.

ORCHID TECHNOLOGY ProDesigner Plus

If you have a multiscanning monitor with analog inputs and enough range, our \$499 test version of the ProDesigner Plus, which includes a \$100 256K RAM upgrade, will handle images from virtually any software you have—emulating everything from MDA and Hercules all the way

up to 1,024 by 768 pixels in 16 colors.

Essentially a VGA board with high-resolution enhancements, the ProDesigner uses a standard 18-bit DAC to put a maximum of 256 colors from a palette of 256K on-screen. At its heart is a Tseng Laboratories VGA chip and Orchid's own BIOS. The full-length, 3-inch-high board will work in 8-bit or 16-bit slots. Standard equipment includes 256K of 100-nanosecond video memory.

While the ProDesigner supports both

Goodbye, Paper Chase Hello, Instant Recall™

Drowning in Information?

All those phone numbers, bright ideas, schedules, reports, stray facts, and to-do lists aren't going to stop coming at you fast and furiously.

You need a better way to manage it all. So everything's organized and at your fingertips. So separate pieces are pulled together into a coherent whole. And you can *harness* the information, using it to forge ahead in your work—better and faster.

Introducing Instant Recall: The First Personal Information Manager that really works

Instant Recall is the only full-featured PIM that's *memory resident*, *popping up over any software you use*—without interrupting your workflow. An incredible time-saver. And something no other personal information manager can offer.

Plus, it's memory-resident in just 32K (about half the memory needed by Sidekick®), leaving plenty of room for other programs.

Instant Recall replaces desktop organizer and text database software with an *integrated solution*. It makes connections between pieces of information. Gives you multiple perspectives. Creates time-lines from dates you've entered piecemeal. So it *actually shoulders much of the work for you*. And it's truly easy to start up and use.

Instant Information your way

Instant Recall takes any kind of information. Structured or freeform. Any single item can include up to 65,000 characters (over 30 pages) of text. And *four familiar formats handle it all*:

Notes: for freeform text—ideas, memos, lists, reports.

Tasks: for tracking and delegating, with priorities, target dates, advance notice.

Schedule: for managing time—with automatic conflict checking, recurring events, week-at-a-glance display.

People: for names, addresses, phone numbers, unlimited notes. With follow-up dates, auto dialer, address copy to any word processor—you'll never type an address again!

Integrated views make connections for you, speeding your work

Instant Recall lets you pull together notes, tasks, schedules, and people information on a *single screen—by topic, date, person, priority, or embedded text*.

Instant Recall also brings time-sensitive items to your attention on any date you choose. You can set advance notice for upcoming activities. View overdue items. Or automatically pop up alarm messages over other software.



Ready to use right out of the box

Instant recall comes ready to work for you from day one. An intuitive user interface and context-sensitive help make it exceptionally easy to learn and use. You don't have to retype information that's already on your computer—Instant Recall has a built-in clipboard for pulling information directly from other programs and ASCII files. Plus transfer utilities for Sidekick®, Tornado™, MemoryMate®, and delimited ASCII.

Other unique features lighten your load

Instant Recall is the *only* general purpose PIM which offers a pop-up activity timer, a phone dialer, alarm messages, scheduling and tasks for multiple individuals and groups, automatic conflict checking, advance notice,

and recurring activities.

Other convenient features include mailing lists and labels, direct copy of name and address to any word processor, overdue notice, follow-up dates, password protection, flexible printed reports, and a clipboard for exchanging text with other programs.

Try Instant Recall free for 30 days

Experience the difference Instant Recall makes—the remarkable gain in control, speed, and effectiveness. You can't lose. Because this cutting-edge PIM is completely guaranteed. If you're not 100% satisfied, simply return it for a full refund—no questions asked.

So order Instant Recall today. And be on top of things tomorrow.

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Yes! I want to eliminate the paper chase with Instant Recall. I understand that this innovative PIM is completely guaranteed. If not completely satisfied, I may return it within 30 days for a full refund. Enclosed is my check for \$99.95 plus \$500 shipping and handling (AZ residents add 7% sales tax).

Name _____

Address _____

City _____

State _____ Zip _____

Day Phone (_____) _____

Check disk size: ☐ 5.25" ☐ 3.5"

Charge my ☐ Visa ☐ Mastercard ☐ Amex

Card # _____ Exp. _____

Signature _____

Here's what the experts say:

Power: "Instant Recall delivers high-end features at a bargain price"
October 17, 1989



Ease of Use: "It's Instant Recall's ease of use that really sets it off [from Agenda and Grandview]"
October 9, 1989



Value: "One of the best values in software I've tested in some time" *September 1989, Tim Bajarin, Personal Computer World*



*Instant Recall is always
just a keystroke away—yet
it needs only 32K of memory*

Hardware Compatibility

IBM PC, XT, AT, PS/2, or compatible, 512K RAM (32K RAM in background mode), DOS 2.1 or higher (DOS 3.0 or higher for memory resident operation), at least 720K capacity on a floppy or hard disk.

CIRCLE 117 ON READER SERVICE CARD

CHRONOLOGIC
CORPORATION

5151 North Oracle · Suite 210 · Tucson, AZ 85704
Tel (602)293-3100 FAX (602)293-0709

Toll free: 1-800-848-4970

PC410



FACT FILE

ProDesigner Plus

Orchid Technology, 45365 Northport Loop West, Fremont, CA 94538; (800) 767-2443, (415) 683-0300.

List Price: \$499.

Requires: VGA monitor for standard video modes or high-resolution monitor for 1,024-by-768 output

In Short: An enhanced direct-access VGA board that handles software meant for any standard display adapter including Hercules but not 8514/A; the adapter includes a font editor and a hotkey zoom utility—both nifty features not often found elsewhere.

CIRCLE 612 ON READER SERVICE CARD

interlaced and noninterlaced operation at its highest resolution, it is not compatible with IBM's 8514/A. On the other hand, its VGA compatibility is very good, with some roughness in our Scroll Window test its only shortcoming. At its higher resolutions, the ProDesigner requires a monitor capable of a 48.8-KHz horizontal frequency and a 60.8-Hz vertical frequency; interlaced operation at 1,024-by-768-pixel resolution uses normal 8514 monitor parameters.

Orchid includes drivers for popular applications and environments, including *Microsoft Windows/386*. In text modes, it will display up to 132 columns and 44 rows on-screen. A special driver program, VMODE, shifts between emulations in either command-driven or menu-driven modes. Orchid also supplies a font editor and hotkey zoom.

Setup requires adjusting but one jumper. The only bothersome part of the installation procedure was having to copy the *Windows* setup disk and copy files onto it—an annoyance if you have only one high-density drive.

If you need a wide range of emulations and good VGA compatibility at a small price, Orchid Technology's ProDesigner Plus ranks as a top choice.

PERSONAL COMPUTER GRAPHICS CORP.

PCG Photon Performa

Even though the PCG Photon Performa isn't quite as refined as some of the other adapters we've reviewed—especially those for *Microsoft Windows*—you won't

COVER STORY

1024 GRAPHICS ADAPTERS

find an adapter with better *AutoCAD* screen-regeneration performance at anywhere near the Performa's new bargain price of \$595 with 1MB of video RAM.

The Performa's secret is that it does display-list processing (you'll want at least 512K of EMS memory to take advantage of this feature, plus 1.25MB for *AutoCAD*), but the Performa does it without the price penalty of a TI coprocessor.

A direct-access graphics adapter, the Performa achieves resolutions of up to 1,024 by 768 in 16 colors from a palette of 256K, and up to 256 simultaneous colors at 800-by-600-pixel resolution and lower. In text mode, it can display up to 132 columns by 25 rows. At the other end of the resolution range, the Performa supports all monitor and software display standards, analog or digital, from MDA and Hercules through VGA. For its highest-resolution modes, however, you need a multiscanning monitor capable of a horizontal frequency of at least 45 KHz. (50 KHz is better and separately supported.)

The 8-inch-long board is based on a proprietary graphics chip and 1MB of soldered-down 80-nanosecond memory. Its BIOS is also a Personal Computer Graphics Corp. product. The Performa uses a 16-bit interface, and you set jumpers to choose manual or automatic selection of 8- or 16-bit compatibility and operation. Other installation settings allow matching the board to different cable types using composite or separate sync. The PCG Photon



FACT FILE

PCG Photon Performa

Personal Computer Graphics Corp., 5819 Uplander Way, Culver City, CA 90230; (800) 255-9893, (213) 216-0055.

List Price: \$595.

Requires: EGA or better monitor for standard video modes or high-resolution monitor for 1,024-by-768 output.

In Short: A direct-access graphics board enhanced with display-list processing that's backward-compatible with all display standards up to and including VGA. A real *AutoCAD* workhorse; alas, the PCG Photon Performa didn't do well under *Windows*.

CIRCLE 613 ON READER SERVICE CARD

Performa board even includes individual trimmer potentiometers for each of the analog primary colors.

In testing, the Performa's *Microsoft Windows/386* screens proved disappointing. While the adapter was nimble—about twice as fast as other boards near its price—it also took a number of pratfalls. The screen was filled with noise and plagued by snow. Running *AutoCAD*, however, problems disappeared and the Performa zoomed along. Drivers are included that provide the normal range of applications and environments. A Presentation Manager driver is available to you by special request—it doesn't fit on the distribution disk.

You'll get a better image and better performance on *Windows* elsewhere, but if *AutoCAD* is your main application, choose the PCG Photon Performa.

PERFORMANCE TESTS:
1,024-BY-768 GRAPHICS ADAPTERSGRAPHICS PERFORMANCE
TESTS FOR MICROSOFT
WINDOWS, VERSION 1.0

This new PC Labs test suite shows how well graphics adapters perform under *Microsoft Windows*.

The **BitBlt Alignment** test uses the *Windows* function BitBlt (bit-block transfer) to move a square block of pixels rapidly from one location to another. We are reporting the results for BitBlts configured as 256 by 256 pixels, using the Source Not Aligned and Destination Not Aligned options for all these tests (a worst-case scenario). In this case, *alignment* means that the

bits describing each row of the bitmap begin on an 8-bit boundary—the start of a byte.

The **Random Rectangles** test draws randomly sized rectangles in random colors.

The **Dialog Boxes (Show and Destroy)** test generates and erases a *Windows* dialog box 20 times.

The **Scroll Window** test scrolls aligned and unaligned text vertically through a rectangular window.

The **Rectangular Clipping (Lines)** test for *Windows* creates four separate, equal, rectangular windows on-screen with space in between them. A full-screen image composed of solid lines is then clipped to the windows.

CONTINUES

COVER STORY

1024 GRAPHICS ADAPTERS

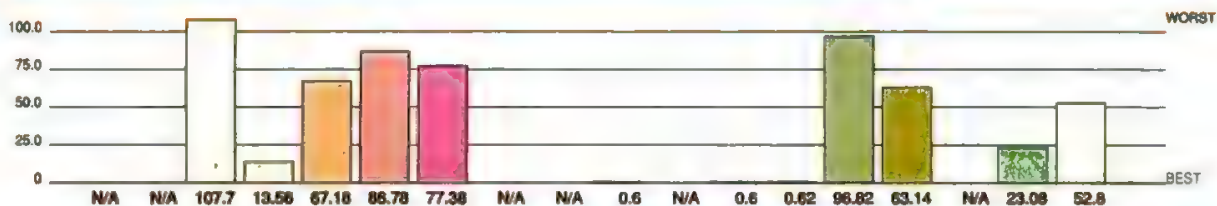


PERFORMANCE TESTS: 1,024-BY-768 GRAPHICS ADAPTERS

GRAPHICS PERFORMANCE
TESTS FOR MICROSOFT
WINDOWS, VERSION 1.0

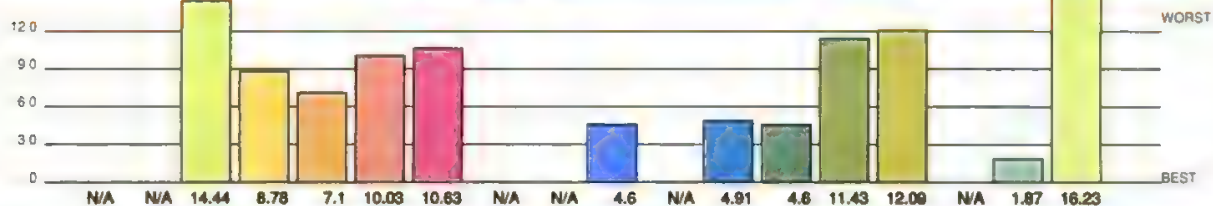
BitBit Alignment

Elapsed Time (milliseconds)



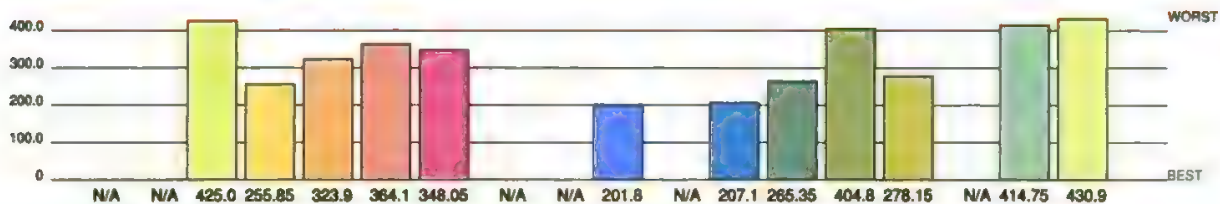
Random Rectangles

Elapsed Time (milliseconds)



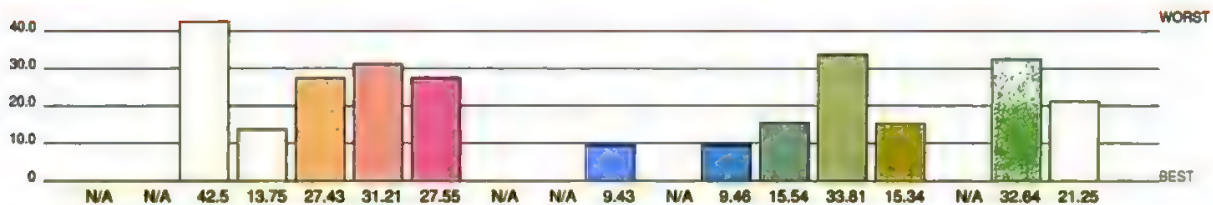
Dialog Boxes (Show and Destroy)

Elapsed Time (milliseconds)



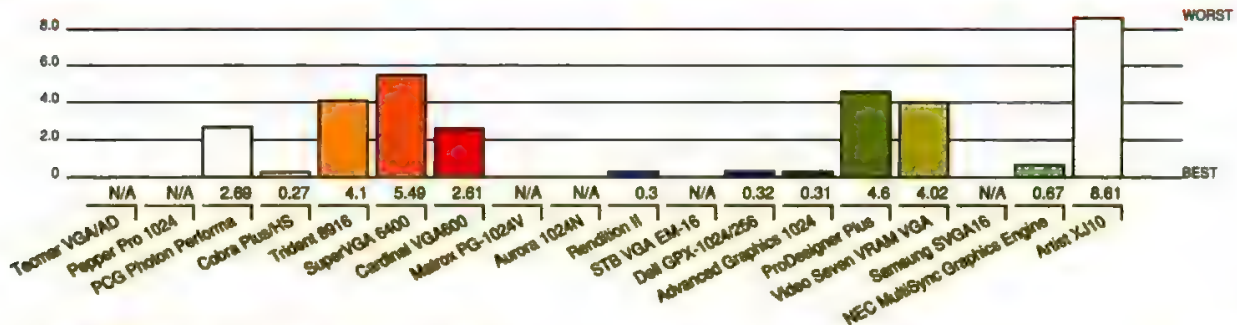
Scroll Window

Elapsed Time (milliseconds)



Rectangular Clipping (Lines)

Elapsed Time (milliseconds)



N/A—Not applicable: this test was not run because the tested configuration lacked a driver, a VGA adapter, or a VGA daughtercard.

CONTINUES

Desktop Video? Can Do!



AT-COMPATIBLE



NTSC/VHS



BROADCAST QUALITY



S-VHS



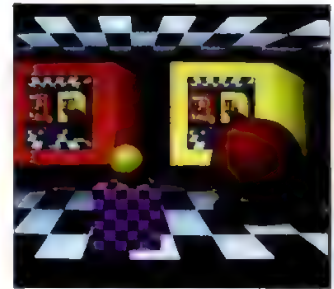
TRANSITION EFFECTS



OVERLAY (ANY-COLOR KEY)



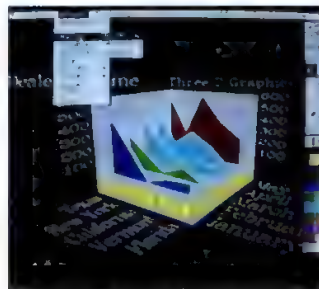
FADE



640 x 480 256 COLORS



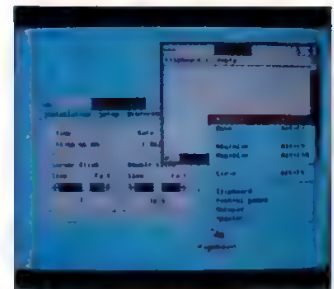
ANY SOFTWARE



ANY SOFTWARE



ANY SOFTWARE



ANY SOFTWARE

"VGA Producer... [gives] you many of the same capabilities as professional video-effects equipment that costs over ten times as much... The system is so easy to use that you may well find yourself using all but the most sophisticated features just by following your instincts."

PC Magazine
28 Nov 1989

CIRCLE 360 ON READER SERVICE CARD

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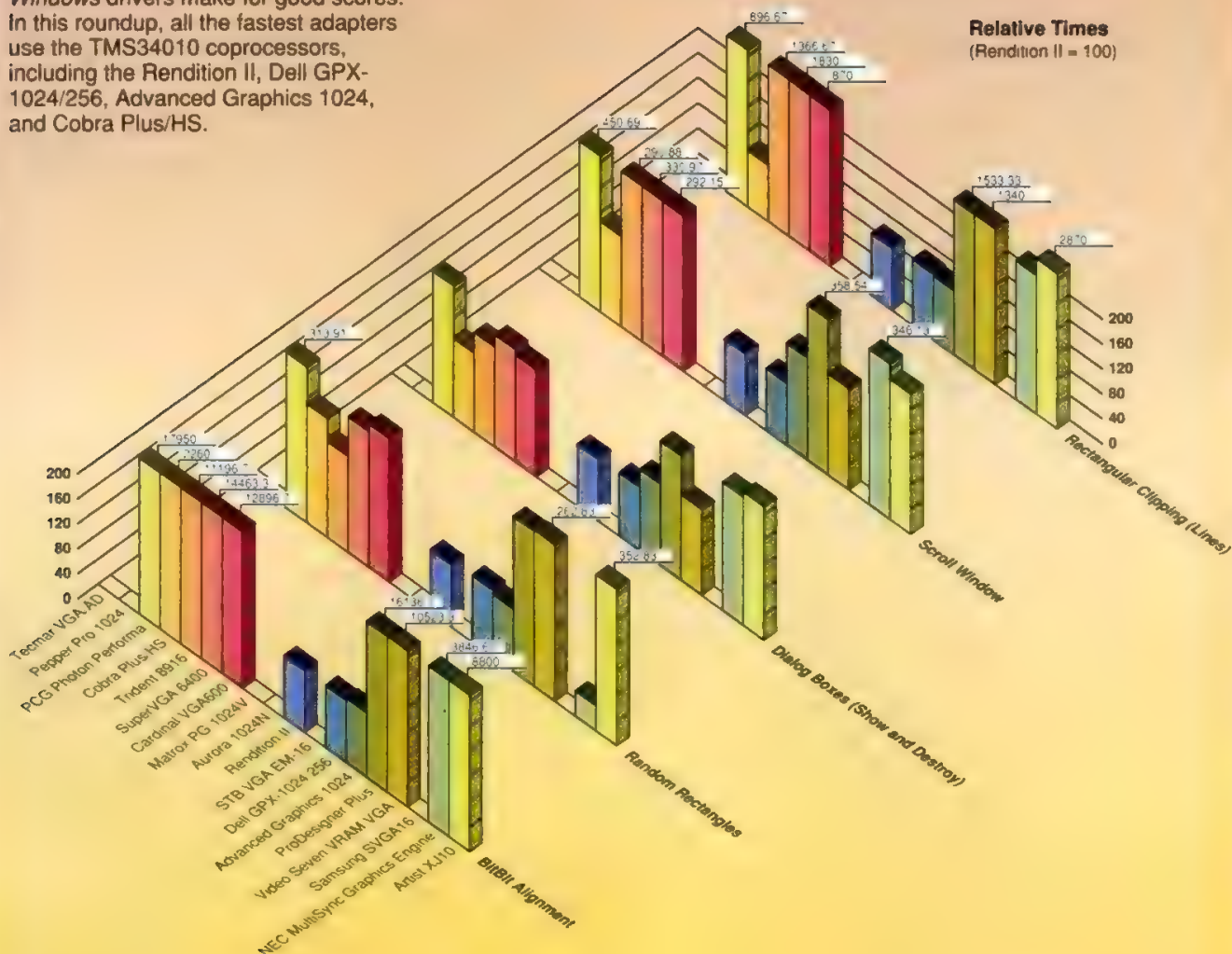
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GRAPHICS PERFORMANCE TESTS FOR MICROSOFT WINDOWS, VERSION 1.0: COMPOSITE VIEW

On the Graphics Performance tests, fast graphics processing and efficient *Windows* drivers make for good scores. In this roundup, all the fastest adapters use the TMS34010 coprocessors, including the Rendition II, Dell GPX-1024/256, Advanced Graphics 1024, and Cobra Plus/HS.



ENDS

RENAISSANCE GRX INC.

Rendition II

When it comes to speed and polish, the Rendition II from Renaissance GRX stands out. Consistently one of the fastest coprocessor-based graphics adapters, the Rendition II shows a certain mastery of the TMS34010 chip. That's understandable, because Renaissance GRX helped Texas

Instruments develop the TIGA interface.

In addition to its coprocessor, the basic \$1,495 Rendition II includes 512K video memory and 384K of instruction memory and is capable of displaying 1,024-by-768 images in 16 colors drawn from a palette of 16.7 million. Stepping up to 1MB of video memory and 512K of instruction memory brings the simultaneous-color total to 256 and the price to \$2,095.

In addition to its high-resolution mode, the Rendition II can also display resolu-

tions of 640 by 480, 800 by 600, and 960 by 720 pixels noninterlaced, as well as 1,024 by 768 interlaced. It's compatible with the 8514/A Application Interface and TIGA-340.

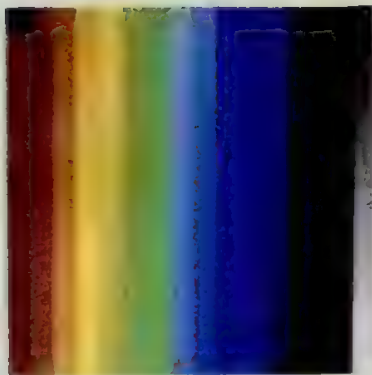
Typically, the Rendition II operates as a pass-through graphics board in conjunction with a VGA card. However, it also accepts a \$300 VGA daughtercard, which turns it into a complete single-slot video system—and our \$2,395 tested version. It also works with an MDA, Hercules,

Most VGA monitors this colorful,



Image created on the Samsung VGA-GraphicMaster™ color monitor using RIX Softworks, Inc. Software.
Unretouched photograph. © 1989, Samsung Information Systems America, Inc.

cost 20% more.



The Monarch butterfly is one of Mother Nature's most splendid creations.

And as you can see, Samsung's new high resolution VGA color monitor vividly brings to life its rich colors and striking contrasts.

Capable of displaying an unlimited palette of colors, the VGA-Graphic Master's™ 14-inch screen with 640 x 480 resolution creates images of superb quality. The tight .31mm dot pitch keeps everything from graphics to type super-clear and razor sharp.

Add to that convenient, up-front controls, a non-glare screen and tilt-swivel base for comfortable viewing, and you've got an array of features that add up to a monitor costing hundreds more.

But this, of course, should come as no surprise. Because along with outstanding performance, Samsung has for years enjoyed a reputation for unmatched value and reliability. All of which have gone a long way toward making Samsung the world's largest monitor maker, with over 8 million units sold.

So if you're looking for high performance, for a lot less, take a good look at Samsung.

For literature or the name of your nearest Samsung distributor, call 1-800-446-0262.



SAMSUNG

CIRCLE 366 ON READER SERVICE CARD



FACT FILE

EDITOR'S CHOICE

Rendition II

Renaissance GRX Inc., Cedar Park, 2265 116th Ave. NE, Bellevue, WA 98004; (206) 454-8086.

List Price: \$2,395 (with VGA daughtercard).

Requires: VGA monitor for standard video modes or high-resolution monitor for 1,024-by-768 output; VGA adapter or daughtercard.

In Short: Among the fastest pass-through coprocessor graphics adapters now available, this one is able to beat out its Dell and Compaq derivatives because of its faster, newer drivers, which give it a strong edge over its competitors.

CIRCLE 614 ON READER SERVICE CARD

CGA, EGA, or VGA board in a two-monitor installation.

A full-length, AT-height expansion board, the Rendition II uses a 16-bit interface but also works in 8-bit slots. Installation requires no more than plugging the adapter into whatever vacant expansion slot you can find in your PC. A menu-driven installation program adds a line to your CONFIG.SYS file that matches the Rendition II to your monitor.

Renaissance GRX includes a full complement of driver software with the Rendition II, including support for the *GEM*, *Microsoft Windows/286*, and *Windows/386* environments, as well as *AutoCAD*. Its *Symphony* driver permits text displays up to 128 characters wide and 64 lines deep. The clear, concise manuals also explain installation for *VersaCAD*, *MicroStation PC*, and the adapter's TIGA and AI emulations.

Clearly among the fastest and one of the most versatile graphics coprocessor boards, the Rendition II's street price may be significantly lower than list, making it price-competitive with its Dell and Compaq brethren. It gets our top nod for its up-to-date, up-to-speed Renaissance GRX driver software.

SAMSUNG INFORMATION
SYSTEMS AMERICA INC.

Samsung SVGA16

Once the Samsung SVGA16 is suitably enhanced, this \$399 direct-access board will handle any video standard, from MDA and Hercules up to 1,024 by 768 noninterlaced, lacking only 8514/A compatibility. The versatility that comes with

PERFORMANCE TESTS:
1,024-BY-768 GRAPHICS ADAPTERS

VGA PERFORMANCE TESTS

Look carefully at these results if you expect to be working in non-1,024 modes. You'll want to be sure you don't encounter a logjam every time you leave *AutoCAD* or another high-resolution application.

The **Unscrolled BIOS Write** test writes to the display screen via interrupt 10H BIOS calls.

The **Scrolled BIOS Write** test also uses interrupt 10H BIOS calls, but with the slower line-by-line scrolling function.

The **Put Pixel** test draws single pixels on the screen graphically.

The **Draw Horizontal Line** test draws horizontal lines on the screen one at a time.

The **Draw Vertical Line** test draws vertical lines on the screen one at a time.

CONTINUES

this board largely results from the SVGA16's Tseng Labs VGA chip.

Unfortunately, making this adapter produce high-resolution, noninterlaced output is not for the technically faint of heart. Replacing the standard 44.9-MHz crystal for the adapter's dot clock with a 65-MHz crystal allows noninterlaced operation in 16 colors but eliminates the interlaced mode of operation. And Samsung does not provide the higher-frequency crystal or the necessary expansion memory even as options. You're left on your own to find them where you will.

Once you have it properly configured, the 9.75-inch-long 16-bit adapter will plug into both 8- and 16-bit expansion slots. Its 256K base memory limits simultaneous high-resolution colors to 16 at 800- by 600-pixel resolution; adding an additional 256K takes the hue total to 256 from a palette of 256K at 800 by 600 and below, as well as at 1,024 by 768. The BIOS bears a Samsung label.

Even without memory enhancement, the SVGA16 offers several extended text modes, all the way up to 132 columns by 44 rows. An 80-column, 60-row mode is also available.

Both 9- and 15-pin D connectors are located on the SVGA's rear bracket to enable you to plug in both digital and analog displays, including everything from ordinary TTL monochrome displays through multiscanning monitors. Matching monitors requires flipping DIP switches through a cutout in the card's retaining bracket and setting one of the adapter's two jumpers. Other than that (and replac-

ing the infamous crystal), hardware setup is nearly unnecessary.

The SVGA16 we tested was accompanied by drivers for all the usual applications except *Microsoft Windows/386*. Unfortunately, the names of the files on the disk supplied with the adapter did not jibe with the documentation, although the names were close enough that with a bit of thought we were able to match them. Several utilities, such as hotkey zoom, are also included.

While the Samsung SVGA16 has its virtues, its need for third-party parts (memory and crystal) may make it too much of a puzzle for nontechnical users and shoppers. But if your dealer is well stocked and accommodating, the SVGA16 may be a good buy.



FACT FILE

Samsung SVGA16

Samsung Information Systems America Inc., 3655 N. First St., San Jose, CA 95134; (800) 446-0262, (408) 434-5400.

List Price: \$399.

Requires: Monochrome TTL monitor or better for standard video modes or high-resolution monitor and replacement crystal for 1,024-by-768 noninterlaced output.

In Short: A universal display adapter that requires more tweaking than the average buyer may be willing to accept. If money is tight and you're not afraid of replacing board components, you should definitely give this one a try. Otherwise, there are simpler investments at comparable prices.

CIRCLE 615 ON READER SERVICE CARD

COVER STORY

1024 GRAPHICS ADAPTERS

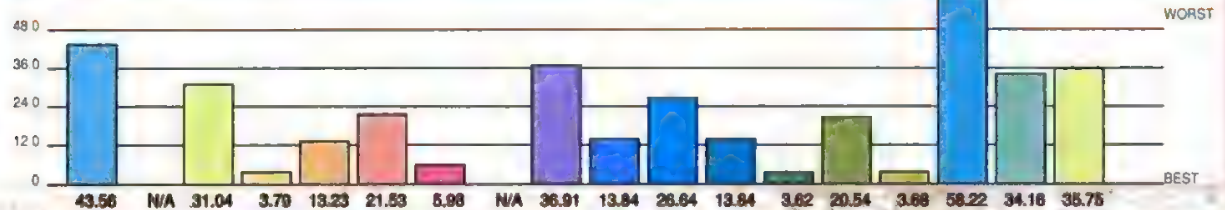


PERFORMANCE TESTS: 1,024-BY-768 GRAPHICS ADAPTERS

VGA PERFORMANCE TESTS

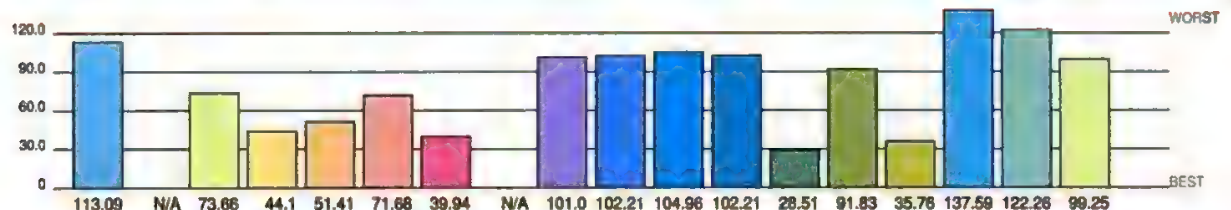
Unscrolled BIOS Write

Elapsed Time (seconds)



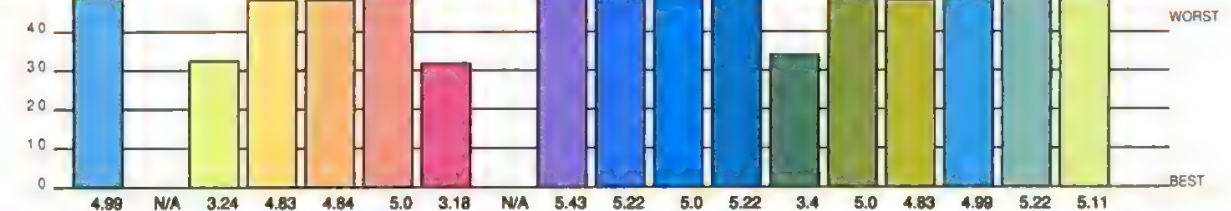
Scrolled BIOS Write

Elapsed Time (seconds)



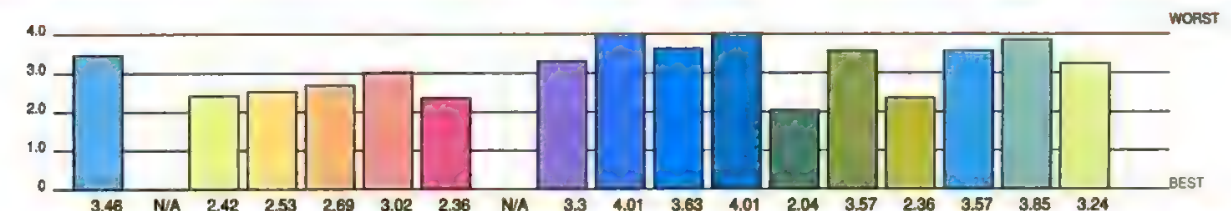
Put Pixel

Elapsed Time (seconds)



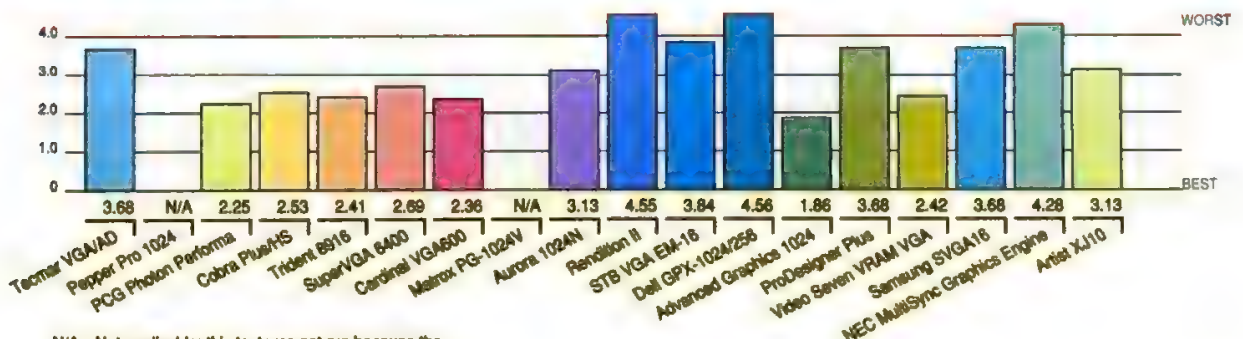
Draw Horizontal Line

Elapsed Time (seconds)



Draw Vertical Line

Elapsed Time (seconds)



N/A—Not applicable: this test was not run because the tested configuration lacked a driver, a VGA adapter, or a VGA daughtercard.

CONTINUES

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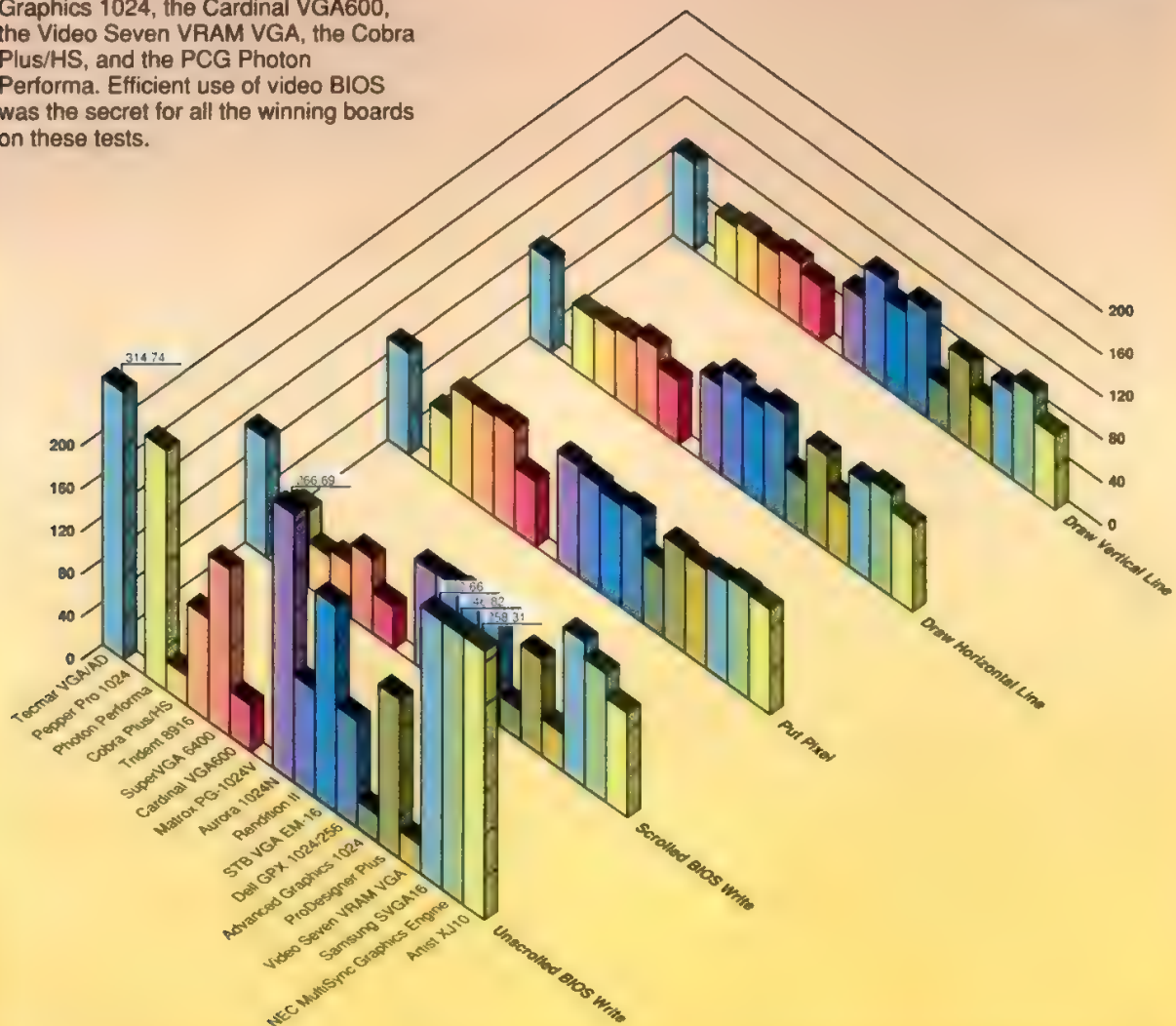
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CIRCLE 200 ON READER SERVICE CARD

VGA PERFORMANCE TESTS: COMPOSITE VIEW

Leading the pack on the VGA Performance Tests were the Advanced Graphics 1024, the Cardinal VGA600, the Video Seven VRAM VGA, the Cobra Plus/HS, and the PCG Photon Performa. Efficient use of video BIOS was the secret for all the winning boards on these tests.

Relative Times
(Rendition II = 100)



ENDS

STB SYSTEMS INC. STB VGA EM-16

Is the STB Systems' VGA EM-16 too much of a good thing? It goes all the way up to 1,024 by 768 pixels in 16 colors, interlaced or noninterlaced, and all the way down to the most primeval of video standards—CGA, MDA, and EGA. Based on Tseng Laboratories' VGA chip and with

256K of 100-nanosecond video memory, at \$369 (an extra 256K of RAM adds \$100 to the price—\$469 for our tested version), the VGA EM-16 supports a whopping 17 text and graphics modes.

Alas, although its software compatibility rates high, its VGA compatibility is far from perfect; some timings are amiss and it scrolls jumpily. It also lacks a coprocessor, making for laggardly high-resolution performance.

The color capabilities of the EM-16 are

limited by its 18-bit VGA DAC to a maximum of 256 simultaneous colors from a 256K palette. The maximum 512K of memory limits the color choice to 16 at resolutions above 800 by 600 pixels.

The 8.5-inch-long adapter requires minimal setup. Four DIP switches, which can be reached through a cutout in the adapter's retaining bracket, match the EM-16 to different monitor types. Nine-pin and 15-pin connectors add hardware compatibility with various monitor standards.



FACT FILE

STB VGA EM-16

STB Systems Inc., 1651 N. Glenville, #210, Richardson, TX 75081; (214) 234-8750.

List Price: \$469.

Requires: Monochrome TTL monitor or better for standard video modes or high-resolution monitor for 1,024-by-768 output.

In Short: A universal direct-access display adapter with unfortunate timing problems, jumpy scrolling, and no high-resolution *Microsoft Windows/386* driver. You should consider checking out better-performing direct access adapters that aren't as expensive.

CIRCLE 616 ON READER SERVICE CARD

On-board jumpers select automatic or manual 8- or 16-bit bus sensing and also determine whether you want to use a digital or analog display. Although the EM-16's Award BIOS is only 8 bits wide, it can be shadowed into RAM for better performance.

Unfortunately, the EM-16 does not include a 1,024-by-768-capable *Microsoft Windows/386* driver—only one for 800 by 600. Most other drivers (including *Windows/286* and GEM) work with full 1,024-by-768-pixel resolution. There is no PM driver currently available for the board. In text modes, the EM-16 allows several high-resolution options, up to 132 columns by 44 rows in 16 colors on digital or analog monitors.

Although the VGA EM-16 does not understand IBM's 8514/A Application Interface, it is compatible with interlaced 8514-type monitors that have a horizontal frequency of 35.5 KHz and with noninterlaced displays that have a 49.0-KHz horizontal frequency. Although this adapter matches many monitor and software standards, it is an unfortunate case of quantity over quality.

TECMAR**Tecmar VGA/AD**

Start with a universal video adapter, mix in backward compatibility with Tecmar's own unusual GraphicsMaster graphics adapter, and top it off with a number of special features and software support, and you have Tecmar's \$580 VGA/AD. Based on the Tseng Labs VGA chip, the VGA/AD will run any standard monitor at any IBM video standard (except 8514/A)

and sprint past 1,024-by-768 resolution all the way up to 1,440 by 720 pixels in 16 simultaneous colors.

The 512K of standard, soldered-down (and nonexpandable) memory endows the VGA/AD with 256 simultaneous colors from a palette of 256K at resolutions all the way up to 960 by 480, and 16 colors at higher resolutions. When running in text modes, the board will display up to 180 columns by 45 rows.

The VGA/AD doesn't stop with software compatibility for MDA, Hercules, CGA, EGA, and VGA standards—it boasts a full register-level match. Its two output connectors—a digital 9-pin and an analog 15-pin high-density—can be used to display different images on different monitors at the same time, an unusual feature. In fact, an on-board register awaits new software that will allow up to five VGA/AD boards to be installed in a single PC, each one displaying a separate image (though no more than one board can be updated at a time). Note that, as with all digital-and-analog boards, the digital output of the VGA/AD is able to simultaneously display only 16 colors from a palette of 64; the full spectrum is available from the analog jack.

The 11-inch-long, XT-height adapter is a marvel of state-of-the-art technology; all components are surface-mounted except for the memory chips and the Tecmar-copyrighted ROM. It uses a 16-bit interface but is also compatible with 8-bit expansion slots. Installation is complicated by a DIP switch and jumpers, but all settings are well documented, with an explicit listing of supported monitors also included. Excellent step-by-step instructions for installing the board's software drivers are also included.

Besides support for the expected environments (*Microsoft Windows* and *GEM*), Tecmar includes drivers for a number of CAD programs—including *AutoCAD* (Versions 2, 9, and 10), *CADvance*, *FastCAD*, *EasyCAD*, *Generic CADD*, *Cadkey*, and *VersaCAD*. *Windows* support includes drivers for Versions 1.0 through 2.1; unfortunately only a test version of a *Windows/386* driver was available for review.

As a universal direct-access graphics adapter, the VGA/AD's only problem is a slightly high price. Choose it for its wider-ranging support and advanced GraphicsMaster modes.



FACT FILE

Tecmar VGA/AD

Tecmar, 6225 Cochran Rd., Solon, OH 44139; (800) 624-8560, (216) 349-1009.

List Price: \$580.

Requires: Monochrome TTL monitor for standard video modes or high-resolution monitor for 1,024-by-768 output.

In Short: A universal direct-access display adapter that's hardware compatible with all VGAs and earlier standards; it also offers extended resolution abilities up to 1,440 by 720 pixels in 16 colors from a palette of 256K. Excellent software support, strong documentation, and the ability to display different images on two monitors simultaneously make this adapter attractive and definitely worth your consideration.

CIRCLE 617 ON READER SERVICE CARD

TRIDENT MICROSYSTEMS INC

Trident 8916

With so many graphics adapters . . . ing—and working—so much alike cause of the proliferation of VGA chips such as the one from Tseng Labs, any entry is welcome. And when it delivers better performance, as Trident Microsystems' 8916 does, a red carpet is warranted.

Based on Trident's own proprietary VGA chip, the 8916 delivers full noninterlaced images at 1,024 by 768 pixels in colors drawn from a palette of 16.7 million hues. In text modes, it will display up to 132 columns by 60 rows. Although the 8916 was not yet for sale when we tested it, you should be able to buy one for \$595 by the time this review appears.

The extra speed of the 8916 comes from an internal 32-bit memory architecture and a cache that permits the use of slower memory chips for the up to 1MB on-board. In testing, the cache gives the 8916 a significant speed boost; it was about 20 percent faster than all other direct-access boards in both *Microsoft Windows* and *AutoCAD* tests.

The 7-inch-long, XT-height Trident 8916 emulates all popular display standards, monochrome and color, up to VGA. It can also operate almost any monitor through its digital 9-pin and analog 15-pin high-density outputs. Although it features a 16-bit interface, it automatically senses and configures itself for 8-bit expansion slots.



FACT FILE

Trident 8916

Trident Microsystems Inc., 321 Soquel Way, Sunnyvale, CA 94086; (408) 738-3194.
List Price: \$595.

Requires: Monochrome TTL monitor or better for standard video modes or high-resolution monitor for 1,024-by-768 output.

In Short: A novel universal display adapter that will handle digital and analog monitors and all display standards VGA and lower; capable of displaying images with 1,024-by-768 pixel resolution in 256 colors from a 16.7-million-color palette; its built-in 32-bit cache gives it a speed advantage over other direct-access boards we tested.

CIRCLE 618 ON READER SERVICE CARD

Setup requires flipping DIP switches through a cutout on the rear panel to match the 8916 to your monitor. The only software installation that's required is for configuring drivers for your software. Drivers available to us during testing included *AutoCAD*, the *GEM* and *Windows* environments, and several applications.

The extra performance won with the internal cache of the 8916 makes it an intriguing high-resolution graphics adapter.

VERMONT MICROSYSTEMS INC.

Cobra Plus/HS

Vermont Microsystems thinks of its Cobra Plus as a price/performance leader. The adapter's base price of \$1,395 makes it an intriguingly inexpensive way of obtaining the power of a graphics coprocessor for your PC. But that tag is only part of the story, because the Cobra Plus comes in several flavors: two interfaces, classic AT bus or Micro Channel (the Cobra Plus/2); two sizes of video memories, 384K or 768K; and two speeds, 40 or 60 MHz (the faster one is the /HS version that we tested). The base-price adapter starts at the lower speed and lower amount of video memory for its TMS34010 coprocessor with 512K of instruction memory; when the Cobra Plus/HS is fully decked out, the price rises to \$3,395.

A pass-through board, the Cobra Plus/HS works in cooperation with a standard VGA board to add noninterlaced 1,024-by-768 resolution to your system, complete with emulation of the IBM Application Interface. It can also be used in

COVER STORY

1024 GRAPHICS ADAPTERS

two-monitor systems. Adding more memory to the low-cost base configuration extends the Cobra's color capabilities from 16 colors drawn from a palette of 256K to 256 simultaneous colors selected from a palette of 16.7 million. The faster crystal in the /HS version makes the adapter faster—about the 50-percent improvement that you'd expect.

The adapter itself fills the full length and height of an AT expansion slot. Installing the hardware requires nothing more than plugging in the board. At most, you'll have to move one jumper to set the port address used by the adapter to avoid conflicts with other peripherals. Should you choose to use it in a one-monitor system, you'll need to link it to your VGA adapter with the short ribbon cable (which will span two slots at most) included with the adapter.

The Cobra Plus/HS requires a multi-scanning monitor capable of handling its 48.8-KHz horizontal frequency for high-resolution output. It plugs into your monitor with its own 4-foot BNC cable, internally linking your VGA card at the same time. (On the Cobra Plus, the rear bracket connector is a 9-pin; on the /2 model, it's a 15-pin high-density connector.)

The Cobra's preferred software interface is its own Professional Graphics Language, although its AI compatibility expands the range of software it can use beyond the drivers supplied with the adapter. For CAD, Vermont Microsystems offers an ADI (*AutoCAD*) driver that supports display lists, as well as drivers for *Personal Designer*, *MicroCADAM*, *PCAD*, and *VersaCAD*; *Microsoft Win-*



FACT FILE

Cobra Plus/HS

Vermont Microsystems Inc., 11 Tigan St., P.O. Box 236, Winooski, VT 05404; (800) 354-0055, (802) 655-2860

List Price: \$3,395.

Requires: VGA monitor for standard video modes or high-resolution monitor for 1,024-by-768 output; VGA or other graphics display adapter.

In Short: This pass-through or standalone coprocessor board based on the TMS34010 chip is available at many speeds and prices. Although it is inexpensive at the base level, faster versions with more memory may price this board out of the competition.

CIRCLE 619 ON READER SERVICE CARD



EDITOR'S CHOICE

- Cardinal VGA600
- NEC MultiSync Graphics Engine
- Rendition II

IBM introduced its 1,024-by-768 interlaced output standard three years ago, but today noninterlaced output has proved itself to be your best bet for high-resolution color graphics. Noninterlaced output is easier on your eyes and, in some cases, your wallet. All the adapters in this roundup produce noninterlaced output at 1,024 by 768 pixels.

The 1,024-by-768 graphics adapters in this roundup are extremely diverse. The group split evenly between boards with coprocessors and boards that use direct access to draw high-resolution images. Priced between \$389 and \$3,395, no one adapter suits all situations.

The best overall performer is the Rendition II by Renaissance GRX. It's fast, versatile, well supported, and, at \$2,395, affordable.

NEC Technologies' MultiSync Graphics Engine is slower than the Rendition II on most tests, but combines everything you'd want on one board. Designed to work with NEC's line of MultiSync monitors but capable of driving any multiscanning monitor, the \$1,499 MGE has a VGA chip set on board.

If you're looking for an inexpensive card, choose the \$389 Cardinal VGA600 from Cardinal Technologies. This 16-bit direct-access VGA board was the least expensive by a small margin and, although it can't match a coprocessor adapter for speed, it provided acceptable performance. The VGA600 is well made, and it will put an image on any monitor in your office.

dows and *GEM* drivers are also available. The *Windows/386* driver we tried demonstrated several problems, but Vermont Microsystems told us that a new version (1.10) will clear them up.

While the Cobra is an excellent adapter with a relatively low base price, its strong-but-not-stellar speed and high fully loaded price will mean that it faces some very stiff competition.

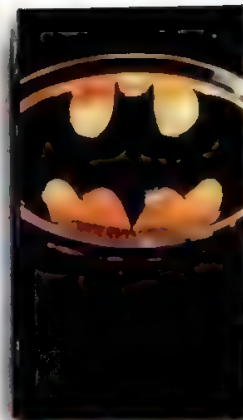


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But is the new crop ready for prime time?

by Lee Thé

Are your calculator's batteries low? Is your pencil sharpener clogged? Can't find your abacus? If you're responsible for counting your company's coin, you may as well place those items in a drawer labeled "obsolete" because now you can bring your accounting system into the computer age—at a price that would make the Scroogiest of money managers grin with miserly pride.

Kiss those dusty ledgers goodbye, and check out five double-entry accounting packages that combine Accounts Receivable, Accounts Payable, Inventory, and General Ledger modules for \$250 or less. These packages are aimed directly at small businesses, corporate profit-and-loss centers, or for use alongside high-end packages for special purposes such as running a separate payroll for the company's executive team.

If these packages seem familiar to those of you who use high-end accounting software, you'll find their origins unsurprising. Four of these five products are simply reduced-price, reduced-feature versions of their highly complex, high-end siblings. Payroll modules themselves are used separately from other accounting functions, however, and aren't reviewed here.

Cougar Mountain's *Act 1*, for example, derives from the rugged but venerable *Act 2* multiuser package. *Peachtree Complete III* stems from a minicomputer program of the '70s. TLB carved *ProfitWISE* out of its middle-aged *Solomon III* multiuser package. *DacEasy Ac*



PHOTOGRAPH BY MICHAEL O'NEILL

counting 4.03 is a complete rewrite of *DacEasy* 3.0, which began as a high-end package for Cado multiuser machines long, long ago. Only Computer Associates' *Bedford Integrated Accounting* was conceived as an entry-level product.

Every powerhouse product reviewed here delivers a lot for the buck, but remember: "low cost" does not necessarily mean "easy." You'll find a lot of clunkiness, both in installation and use. For example, not every module necessarily integrates completely with every other module. If it doesn't, you'll have to enter the same data several times—an amazing necessity for products of the '90s.

The happiest users of such packages tend to be determined do-it-yourself buck squeezers who want a lot from their accounting systems and don't mind laboring to get it. They also have—or get—a modicum of knowledge about double-entry accounting. And these users set realistic expectations about how long the setup will take and how long it will take to learn the system.

Unhappy are those who needed an easier package but bought a challenging powerhouse product instead—perhaps on a salesperson's recommendation, perhaps

because the reports looked so inviting. Then they discovered that those reports can track only data that has been entered regularly, day in, day out. What looked great in theory turned out to be hard slogging in practice.

THIS IS EASY?

But solutions abound for the ease-of-use crowd. You might hire a consultant to handle installation and training. This may cost two to five times the price of the package, but you could then get the most out of one of the powerhouse products. And after all, no law of nature says installation has to cost less than the product. Nor must bosses do everything themselves.

Or you could get one of the packages that are relatively easy to install and use. Among the reviewed packages, *Bedford* stands out in this regard. It's limited, but its defenders have the luxury of saying: "So what? I have it running. Can you say the same for that fancy package you bought?" *DacEasy* 4.03, one of the more complex packages offered here, has made great strides in ease of use. Especially compared with *DacEasy* 3.0.

If your accounting software search hinges on ease of use, focus on *Dac* and *Bedford*. If you can live with a single-entry package, look at the ones we discuss in the bargain software sidebar. If you can spend more than \$250, note that several packages discussed in the high-end market sidebar highlight ease of use as one of their strengths.

MOVING UP, MOVING ON

Ease of use can also come from getting a product tailored to your particular type of business. Unfortunately, this alternative costs a lot more—usually thousands of dollars—and lacks the refinements of advanced standard packages, as well as tying you into far slower product development cycles.

A simple solution would be to purchase a standard package for which you could buy vertical modules, adapting it to your retail business, construction business, legal practice, or whatever.

Indeed, a smattering of this approach is already on the market. For example, the popular *Timeslips* time-and-billing product from North Edge Software ties in to various packages. And Great American Software has announced that it is develop-

THE TESTING PROCESS

PC Magazine and Price Waterhouse tailored these accounting software tests to the low-end market. Because most small businesses typically do not have extensive transaction volumes but can have operating requirements as complex as those of much larger companies, our tests focused on overall functionality. Also, since users of low-end systems may be young companies without formal accounting staffs, ease of use is a prime concern.

We wanted to ensure that each system could adequately perform typical small-business accounting chores. Our team of 11 Price Waterhouse reviewers, all with extensive computer and small-business backgrounds, tested each product according to a 60-page testing script that focused on the General Ledger, Accounts Payable, Accounts Receivable, Billing, and Inventory modules of each system.

This complex script required each reviewer to set up two different companies and to create departmentalized

charts of accounts, vendors, customers, inventory items, and associated beginning balances. The reviewers then simulated the operation of both companies for one year, including basic routines such as recording invoices and check-writing. More-complex steps such as voiding checks, entering physical inventory adjustments, vendor payment exceptions, bill of materials processing, and recurring and reversing journal entries were also included. Modifications and deletions were made to all master-file items.

While performing each step, reviewers also looked at several general areas: adequacy of the audit trail, usefulness of available reports, relative system speed, ease of use, control over out-of-balance processing, password protection, and system stability.

Other fundamental accounting questions included: How will this software package help me run my business? Can I easily design custom reports? Do the standard reports include recommended

inventory reorder points, profitability by department and inventory item, and sales by salesperson?

We also investigated each program's standard query functions. How difficult is it to see when a customer's last check was received, or how many units of a particular inventory item are on hand, committed, or on order?

In addition to this rigorous shake-down, we monitored CompuServe's user forums to observe current users' unsolicited comments about each package, which gave us some insight into their frustrations and successes.

Our regimen recognizes the inherent diversity of small business and focuses on how the products can help you run your business. While these tests can put you on solid ground before you make your accounting software decision, be forewarned that your ultimate selection should be guided by your own requirements—which only you can define—and how well these packages will meet those requirements. ■

ing a set of vertical modules for its *One-Write* line, due out some time in 1990. The costs of one of these packages will lie somewhere in between those of the review packages and those of specialized turnkey products.

Another way to add to your low-end package is to look into Accuret, a check reconciliation service sold by banks. Each month, Accuret users each receive a disk containing a bank statement file in the mail. They simply pop the disk into a computer, and the Accuret software reads the bank statement from the disk, accesses checking account information from their personal accounting software, and reconciles the two automatically.

Of the five packages reviewed here, only *Bedford Integrated Accounting*, *Dac-Easy*, and *Peachtree Complete III* are directly supported by Accuret. But because Accuret also reads *Lotus 1-2-3* and ASCII files, users of virtually all accounting packages can take advantage of the system by converting their checking account data into one of these formats.

Accuret hasn't quite swept the country yet (banks in only four states offer this service), but at least ten more banks are being added by the end of 1990. Monthly costs for the service vary from bank to bank; for example, First Interstate California charges 7 cents a transaction, with a \$4.95 minimum per month and no up-front cost for the software. Once it becomes more widely available, Accuret can cure a lot of headaches for very little money and a minimum of fuss.

WAITING FOR GUI

While power users will also find much to interest them in these reviews, read the high-end packages sidebar "How Big Is Your Business?" before putting your money down. The products described there cost two to five times more than the ones we reviewed, but you may find the increase in functionality well worth the extra bucks.

You will also find that the line between "power" products and "ease-of-use" products is steadily blurring, with *Dac-Easy 4.03* the outstanding blend so far. Note that this is still a character-mode product, however.

Packages with true graphical user interfaces (GUIs) will potentially improve ease of use so much that power features will be accessible to most users. This change will derive from such improvements as matching on-screen forms like invoices and

THE PRICE WATERHOUSE TEAM

Our Price Waterhouse evaluation team is comprised of ten professionals from offices in North America. Many others have contributed to the Price Waterhouse reports since their inception in 1983.

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statements to the paper forms you use, and from making ad hoc query accessible via mouse-driven point-and-click operations. Needless to say, you will need at least a fast 286 machine with several megabytes of memory, ample disk space, and a VGA display to make one of these GUI marvels perform properly.

Look for graphical accounting packages to start appearing in 1990, both from firms that currently produce Macintosh-based accounting products, such as Computer Associates and Great Plains, and from firms close to IBM or Microsoft—two companies that are heavily promoting graphical product development.

One example is Advanced Business Microsystems (ABM), whose high-end character-based *Platinum Series* account-

ing package is being marketed by IBM. We have seen early alpha samples of ABM's graphical product. Still no telling when it will ship, but what we saw lived up to our expectations. It will probably cost around twice as much as the products reviewed here.

NO TROPHIES HERE

We'd love to tell you that the current crop of products are the Toyota Corollas and Honda Civics of accounting packages. Actually they're more like Ford Pintos and Chevy Chevettes—functional but long of tooth.

The main failing across the board lies in their management reporting and query capabilities. Accounting vendors say that users don't show much interest in this aspect

PRICE WATERHOUSE REPORT LOW-END ACCOUNTING

of accounting software. But none of the vendors have supplied easy ad hoc data query in their packages, and not all include a cash flow report as part of their standard reporting modules. When these features become available, we predict that sharp managers will use them.

It's clear then, that the millennium hasn't yet arrived for budget-priced accounting software, but you can get the job done with what's currently available. In the reviews that follow, you may find a package that brings you one step closer to that millennium.

Act 1

by Raymond A. August and
Timothy J. Lee

Cougar Mountain Software has come up with a package that does not score high on glitz or ease of use for the first-time computer user. But *Act 1*, sold for \$199.50, makes up for its first impression by scoring high on function and features.

The basic package integrates General Ledger, Accounts Payable, Accounts Receivable, Order Entry/Invoicing, Inventory, Payroll Entry, Check Reconciliation, and *Lynx* (a product to import or export delimited ASCII data files) into its single-

user, batch-oriented accounting system. An optional Job Cost module is available, as well as a module for Fund accounting, at a cost of \$199.50 each.

Its documentation is well organized, and its installation procedures are geared for user customization. On-line help consists of a reference field on the screen that identifies the section in the module documentation describing the options.

Unfortunately, *Act 1* does not have the full-screen edit capability of many of the newer packages in which data entry is accomplished by moving sequentially through the data fields. You can't simply back up if you need to revise something. Instead, you have to specify the line number from a command line at the bottom of the screen.

When you're ready to set up *Act 1*, spend a little time going through the brief tutorial to get a grasp of the package's basic features. Then spend some more time with the documentation to understand how to establish each module for your business. Lookup windows are available for some of the data field options.

The General Ledger, which follows a batch control approach, allows for account codes of up to 15 characters and consoli-

dates up to 30 companies into one entity.

There are ten types of account codes, including contra accounts, operating accounts, and nonledger accounts. The nonledger accounts can be used for memo accounts as well as for statistics such as

Act 1

Suitability To Task

	0	1	2	3	4	5
Ease of Use				✓		
Functionality						✓
Accounting Controls				✓		
User Interface			✓			
Value					✓	
Enterprise Management				✓		

operating volume, number of units sold, or other values that can be combined on custom financial reports to yield more meaningful performance measurements.

You may also import a delimited ASCII file to create a batch file for editing and posting. An allocation processing function allows for recurring or reversing transac-



LOW-END ACCOUNTING SOFTWARE: SUITABILITY TO TASK

The category of low-end accounting software is determined by list price, not by features. Use the Suitability to Task ratings to find products that are designed for businesses with priorities like yours, then focus on the reviews of the most appropriate products.

Each package is rated for its usefulness in six areas: Ease of Use, Functionality, Controls, Interface, Value, and Enterprise Management.

Ease of Use looks at what it takes to do fundamental bookkeeping tasks with minimal training and attention. It combines ratings on simplicity of operation with the quality of the help features and documentation.

Functionality addresses advanced accounting tasks. It covers both the range and the depth of the functions, as well as the availability and utility of whatever upgrade path the vendor offers.

Accounting Controls deals primarily with how well the product can help you go through an audit—as well as how effectively it can prevent one from happening. Does the program create a strong audit trail, trap errors before harm is done, keep intruders

out, and make sure that your system is always in balance? On the minus side, does it have any bugs that could corrupt your database?

User Interface refers to the sophistication with which the package helps you access its functions. This category takes into account the complexity of the tasks being tackled, which the Ease of Use category does not.

Value reports on bang for buck—balancing outlay against return on your investment.

Last but not most important for growth-oriented managers, **Enterprise Management** rates report and query capabilities, both standard and optional. Here we address the question, How will this package help me run my business?

THE RATINGS

- 0—No such capabilities offered
- 1—Poorly suited overall
- 2—Somewhat capable
- 3—Well suited
- 4—Superior capability
- 5—Outstanding; rivals capabilities of midrange accounting software

Act 1

Suitability To Task

	0	1	2	3	4	5
Ease of Use				✓		
Functionality						✓
Accounting Controls				✓		
User Interface			✓			
Value					✓	
Enterprise Management				✓		

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tions. Allocations can include a percent of an account total, a fixed dollar amount, or a combination of the two.

Accounts Payable monitors cash conservation. You can specify a default due date for each vendor, track mail float days by vendor, and maintain a "Days to Lose Discount" field that indicates for each vendor how many days past the original due date you will still take discounts.

ACT 1 uses general codes to save data entry time. Recurring expense codes can be used for selecting items to generate transactions based on payment frequency or other groupings. Allocation table codes are used for distributing expenses on invoices. You can specify up to ten check formats for each company by copying the default format and modifying for your specific needs.

Accounts Payable allows for printing 1099s and allows currency conversion during invoice processing. The Check Reconciliation module lets you reconcile both AP and Payroll checks.

Stock items and new vendors can be added to the inventory master file during invoice entry. Cash basis accounting may be accomplished by selecting to expense invoices only when they are paid. This, combined with some additional procedures, allows a cash basis business to properly treat expenses. For example, in AR you can opt not to account for revenue until the cash is actually received.

Like the Accounts Payable module, the Accounts Receivable module handles cash discounts well, giving you the ability to tie discounts to the transaction date, a specific day in the month, or a number of days from

PRICE WATERHOUSE REPORT LOW-END ACCOUNTING

the end of the month.

Transactions can also be established to record cash receipts not related to accounts receivable, such as cash sales. Prepaid and credit memos are easily handled. Each

In addition to Sales Analysis reports, reports for inventory back order, back order allocation, and inventory reserve allow you to track current status on scarce, high-demand inventory.

Inventory costing methodologies include FIFO, LIFO, weighted average, and standard cost. ACT 1 is not designed to han-

The screenshot displays the ACT 1 software interface for managing bank accounts. At the top, it says "Bank Account Code: EPY" and "Change General Information". Below this, a list of fields is shown with their corresponding values: Account Number (0174-467009-1356), Account Desc (Executive Payroll/1st Pacific), Contact Name (Robin Hessling), Bank Name (1st Pacific Savings & Trust), Bank Address 1 (19000 Pacific Highway), Bank Address 2 (East Tower, Suite 3000), Bank City (Vancouver), Bank State (Washington), Bank Zip Code (98007-0038), and Bank Phone Number ((206) 555-1212). The current balance is listed as \$45,907.69. A "Reconciliation Order" box is highlighted, showing options 1 (Check/Book) and 2 (Item Date). Below this, a list of reconciliation options is shown: 18. Recow. Order, 19. Balance Meth: Stmt to Book, 20. Dup. Checks: No, 21. Check Format: 1, 22. Stmt Amount: \$45,907.69, 23. Display Financial Information, and 24. Delete. At the bottom, it says "Enter the Appropriate Reconciliation Order (See Legend)".

ACT 1's check reconciliation feature allows you to select both the check reconciliation method and the sort order. It handles multiple bank accounts, fees, earned interest, miscellaneous additions and deductions.

dle multiple warehouses. With the bill of materials function you can maintain inventory items that are combinations of other parts. Individual reports allow you to plan production, promotions, and analyze potential profit.

The newest module, Check Reconciliation, may be integrated with the General Ledger, Accounts Payable, and Payroll modules. The new module tracks cash for any number of bank accounts—reconciliation may be either from your books to the bank statement or from the statement to your books. You can choose to enter just the check number or the check and dollar amount. It handles statement reconciliation with deductions, deposits, bank charges, and interest. It can even handle recurring items, such as a fixed bank service charge. Transfers between accounts can be handled, and checks can be written from this module to supplement Payroll and Payable capabilities.

Lynx, a module designed to import and export data, is standard. You may wish to import master file data, such as a chart of accounts, customer or vendor records, or even inventory records, or import to update existing records. The Snow Report Writer (\$249), a third-party package available with many higher-cost accounting

customer may have a billing and shipping address, but if your customer has multiple shipping addresses, you will need to override the address when shipping. ACT 1 accommodates reports for collection monitoring and assigning receivables to factors.

Order Entry maintains support for point-of-sale terminals with cash drawers and allows up to six price levels, inventory returns, reserved inventory, and flexible statement formats. Statements and invoices may contain comment lines that are either saved to the history file or just printed on the statement. The combination of recurring invoices and noninventory line items works well for businesses that have service contracts.

Period closing tasks require sequentially choosing menu options and then updating the accounting period in the master profile. What the package lacks is a comprehensive administrator's report to show what period-end processing has been done for each module.

FACT FILE



ACT 1, Version 7.22

Cougar Mountain Software, 2609 Kootenai, P.O. Box 6886, Boise, ID 83707; (800) 344-2540, (208) 344-2540.

List Price: ACT 1, \$179.50, or Fund 1, \$199.50; Job Cost, \$199.50; Custom Report Writer, \$100.00.

Requires: 256K RAM; hard disk, DOS 2.0 or later.

In Short: While ACT 1 isn't famous for a particularly elegant user interface, it does provide high functionality at a good price. Notable features include customization of forms, strong invoicing, customer statements, and available upgrades to Unix or a LAN.

CIRCLE 306 ON READER SERVICE CARD

PRICE WATERHOUSE REPORT LOW-END ACCOUNTING

systems, is now available for use with *Act 1*. This menu-driven report writer, which allows you to "paint" reports and save the formats for later use, scores high on ease of use and added functionality.

Act 1 is a good accounting system for businesses with more than basic book-keeping needs. Its ability to design formats for checks, invoices, and statements is a plus for initial implementation. The integration of check reconciliation and inventory are well implemented. The package's batch mode and data-entry methods furnish a controlled processing environment, but this makes for very slow accounting. If speed and ease of use are an issue for your company, then look elsewhere.

Bedford Integrated Accounting

by Raymond A. Auger,
Donald Girard, Janet Phillips,
and Thomas White

The newest member of the Computer Associates family of software products is *Bedford Integrated Accounting*. Previously sold as *Simply Accounting*, this package demonstrates that computerized accounting can be uncomplicated. Not surprisingly, while this \$249 package asks less of its users than do most other double-entry accounting packages, it gives less in terms of reports, feature richness, customizability, and upgradability.

Oriented to small, less-sophisticated

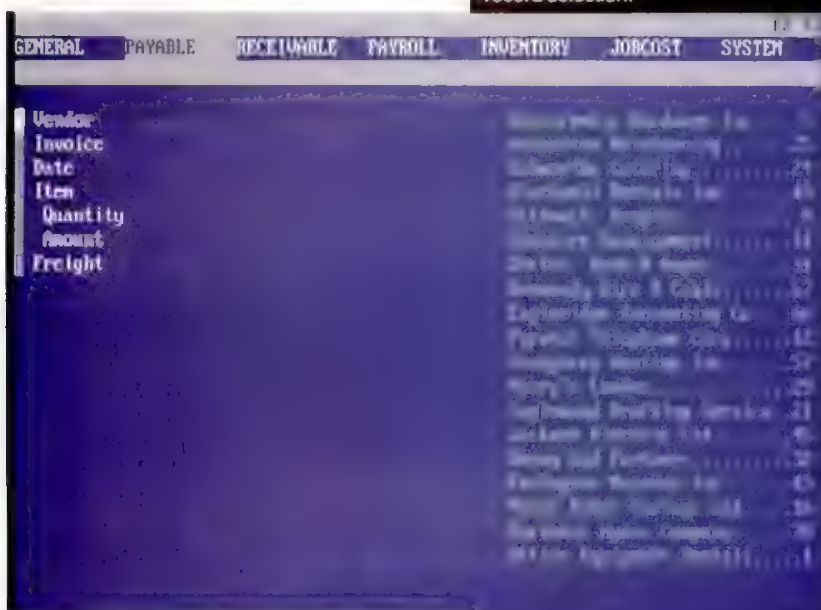
entry-level companies and first-time computer users, *Bedford* contains several features designed to expedite the implementation of the system. The package includes fully integrated General Ledger, Accounts Payable, Accounts Receivable, Payroll, Inventory, and Job Cost modules and is the only one reviewed that does not require a hard disk.

Included are an automated tutorial and accounting manual. The accounting manual is excellent for nonaccountants, and the user guide is equally easy to follow. *Bedford* does not supply on-line help.

The user employs simple pull-down menus to navigate the system. Function-key assignments are consistent from module to module, and *Bedford* displays those assignments in the upper-right-hand corner of the screen. You'll also find that when you move to certain key fields, *Bedford* displays a list of all possible values for that field. For example, when you move to the customer ID field, *Bedford* displays all of the customer IDs and names on the right-hand side of the screen.

Bedford may be easy to use, but you'll still have to get used to odd cursor and Esc-key assignments. When you have finished entering data on a screen, you are required to press the Left Arrow key to save your work. If you press the Esc key to exit as

Bedford Integrated Accounting automatically shows all applicable master-file selections on the entire right-hand side of the screen, enhancing the ease of master-file record selection.



Bedford Integrated Accounting Suitability To Task

	0	1	2	3	4	5
Ease of Use						✓
Functionality			✓			
Accounting Controls				✓		
User Interface				✓		
Value			✓			
Enterprise Management			✓			

you do when exiting from a submenu, all of your data entered on that screen is lost.

The real-time environment of *Bedford* forces all transactions to be immediately posted to the subledger and the General Ledger. Unfortunately, you are not able to print a listing of these transactions prior to posting.

The General Ledger limits you to a three-digit account code with a maximum of 500 accounts. *Bedford* does not allow for departmental codes per se, but instead maintains departmental information for your income and expense accounts with the use of job codes. Each time you specify an account to post to, you are also prompted to enter a job code. But if you use this method to capture departmental data, you will lose the ability to capture Job Cost data for that transaction. Standard general-ledger reports include the Trial Balance, Ledger, and Journal reports. Unfortunately, a Statement of Cash Flows report is not provided.

Bedford's optional \$129 Graphic and Custom Reporting module furnishes you with a tool for reporting graphing data from all modules. Moreover, you can export all of *Bedford's* standard reports to a Lotus 1-2-3 .WK1 file.

Journal-entry input is straightforward. You are not permitted to leave the screen with unbalanced entries, which forces you to keep your books in balance. There is no provision for recurring or reversing entries, prior-year comparison amounts, or the maintenance of budgets.

The Accounts Receivable module offers basic invoicing and cash receipts functions. You can bill for both inventory and noninventory items and services. When an invoice for an inventory sale is entered, *Bedford* displays the current quantity on

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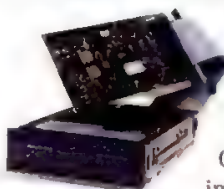
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LOW-END ACCOUNTING SOFTWARE: SUMMARY OF FEATURES

Products listed in ascending price order

	DacEasy Accounting	Act 1	Peachtree Complete III	ProfitWISE	Bedford Integrated Accounting
List price	\$149.95	\$179.50	\$199.00	\$229.00	\$249.00
Other packages in family	Dac Light	Act 2	None	Solomon III	AccPac BPI, AccPac Plus
Upgrade available from same vendor	☐	☒	☐	☒	☐
Hard disk required	☒	☒	☒	☒	☐
RAM required	512K (640K for graphics module)	256K	512K	640K	384K
Posts submodules in detail or summary	Summary	Both	Both	Summary	Neither
User-customized forms (such as checks)	☐	☒	☐	☐	☐
ACCOUNTS PAYABLE					
Program parameters					
Maximum invoices per payment	10	65,535	Unlimited	Unlimited	24
Maximum number of bank accounts	Unlimited	65,535	9	Unlimited	1
Maximum number of AP vendors	Unlimited	65,535	Unlimited	Unlimited	999
AP vendor code structure (characters)	10 alpha- numeric	15 alpha- numeric	6 alpha- numeric	6 alpha- numeric	3 numeric
Maximum number of AP accounts	1	65,535	9	Unlimited	1
Features and functions					
Total purchases last year	☒	☐	☐	☒	☐
Date and amount of last purchase	☒	☒	☒	☒	☐
Last check number, amount, and date	☒	☒	☒	☐ (Date only)	☒
Quick add of vendors	☒	☒	☒	☒	☐
Prints 1099s	☒	☒	☒	☐	☐
Processes recurring batches	☐	☐	☒	☐	☐
Automatically purges inactive vendors	☐	☐	☒	☐	☐
Automatically selects invoices for payment by vendor/due date	☒ / ☒	☒ / ☒	☒ / ☒	☒ / ☐	☒ / ☐
Vendor-specific payment terms	☒	☒	☒	☒	☐
Check reconciliation	☒	☒	☒	☐	☐
Prints standard messages on selected remittance advices	☒	☒	☒	☒	☐
Looks for duplicate invoices	☐	☒	Optional	☒	☐
Cash basis accounting	☒	☒	☐	☒	☒
Calculates discounts based on due date	☒	☒	☒	☒	☐
Creates a one-time vendor	☒	☒	☒	☒	☐
Reports					
Cash projection by due dates	☐	☒	☒	☒	☐
Year-to-date vendor detail report	☐	☒	☒	☒	☒
Cash requirements report	☐	☒	☒	☒	☐
ACCOUNTS RECEIVABLE/ORDER ENTRY/INVOICING					
Program parameters					
Maximum number of customers	Unlimited	65,535	Unlimited	Unlimited	999
AR customer code structure (characters)	10 alpha- numeric	15 alpha- numeric	6 alpha- numeric	6 alpha- numeric	3 numeric
Maximum number of AR accounts	1	65,535	39	Unlimited	1
Number of tax codes/rates per customer	Unlimited	65,535	None	3	None
Features and functions					
Date and amount of last sale	☒	☒	☒	☒	☒
Customer billing address	☒	☒	☒	☒	☐
Multiple ship-to locations in file	☒	☒	☒	☒	☐
Comments (miscellaneous information)	☒	☒	☒	☐	☒
Average days to pay	☐	☐	☒	☐	☐
Processes recurring batches	☒	☒	☒	☐	☐
Customer-specific billing cycles	☐	☒	☒	☒	☐
Customer-specific payment terms	☒	☒	☒	☒	☐
Automatically computes finance charges	☒	☒	☒	☒	☐
Commissions paid	☐	☒	☐	☐	☐
Shipping method	☒	☒	☐	☒	☐

☒—Yes ☐—No

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ACT!	209.
Crosstalk Comm.	
Crosstalk for Windows 1.0	117.
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Dac Easy Bonus Pak 4.0	158.
Dac Easy Payroll 4.0	59.
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Funk Software	
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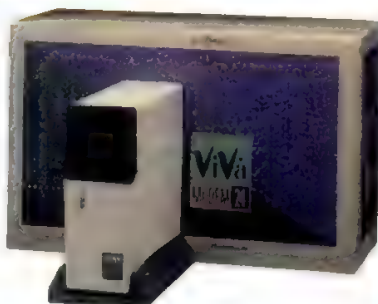
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ViVa24 2400bd Ext. Modem

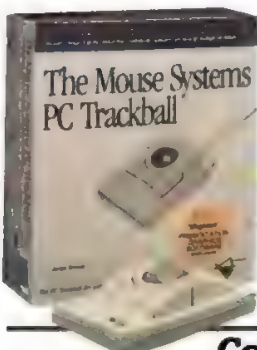
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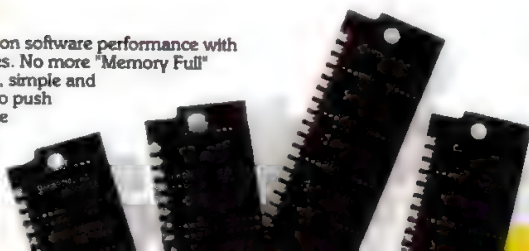
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ALR PowerFlex 286/40Mb	1249.
ALR 386SX PowerFlex Module	345.
ALR i 486 PowerFlex Module	2635.

MEMORY

Samsung	
DRAM 1Mb 100ns	11.
SIMM 1Mb 80ns	120.
SIMM 1Mb 70ns	105.
SIMM 1Mb 100ns	88.

EXPANSION & UPGRADES

AST	
Sixpak 286 with 512K	285.
ATI	
VGA Wonder 256k	267.
Central Point Software	
Copy II PC Deluxe Opt Bd 5.4	103.
Fifth Generation	
Logical Connection 512k	520.
Intel	
Aboveboard Plus 8 I/O w/2Mb	739.
Co-Processors	Call
Orchid Technologies	
ProDesigner Plus	329.
Paradise Systems	
Basic VGA Card	119.
VGA Plus 16	249.
Video 7	
Vega VGA	194.

DRIVES

CMS-Seagate	
30Mb ST238R XT (65ms)	279.
40Mb ST251-1 AT (28ms)	349.
Imagica	
5 1/4" 44Mb Cartridge	79.
20Mb Cartridge	55.
Bernoulli II 44Mb Int.	965.
Plus Development	
Hardcard II 40 (16 bit) (19ms)	605.
Hardcard II 80 (16 bit) (19ms)	705.
Solutions for PC/XT	
3 1/2" 1.44Mb Floppy & Ctr.	157.
3 1/2" 720k Floppy & Ctr.	157.
Trec	
5 1/4" 1.2Mb Floppy Drive	89.

MEDIA & ACCESSORIES

American Covers	
Mouse Mats	7.
BASF Disks (box of 10)	
5 1/4" DS/HD (1.2Mb)	19.
Curtis	
Computer Tool Kit (52 pc)	46.
Ruby Plus w/Fax & Modem	66.
Kensington	
Keyboard Slideaway	35.
Masterpiece Plus	93.



LOW-END ACCOUNTING SOFTWARE: SUMMARY OF FEATURES

Products listed in ascending price order

	DacEasy Accounting	Act 1	Peachtree Complete III	ProfitWISE	Bedford Integrated Accounting
ACCOUNTS RECEIVABLE/ORDER ENTRY/INVOICING					
On-order amount (dollars)	☐	☒	☒	☐	☐
Year-to-date finance charges	☐	☒	☒	☒	☐
Highest balance	☐	☒	☐	☐	☐
On-line look-up of credit info during order entry	☒	☐	☐	☒	☐
On-line look-up of alternate items and quantities on hand	☒	☒	☐	☒	☐
Checks credit limit	☒	☒	☒	☒	☐
Converts quotes to orders	☐	☒	☐	☐	☐
Tracks and fills back orders	☒	☒	☒	☒	☐
Maintains noninventory items	☒	☒	☐	☒	☐
Reports					
Sold serial/lot numbers	☐	☐	☒	☒	☐
Limits statement printing for past-due customers	☐	☐	☐	☒	☐
Sales analysis by customer category	☒	☒	☒	☒	☐
Past-due aging report	☒	☒	☒	☒	☒
Year-end statement	☒	☒	☐	☐	☒
Sales analysis by product	☒	☒	☒	☐	☐
Detail deposit slips for cash received	☐	☐	☒	☐	☐
Cash discounts not taken	☒	☐	☐	☐	☐
Customer price quote	☐	☒	☐	☐	☐
GENERAL LEDGER					
Program parameters					
Maximum number of accounts	Unlimited	65,535	Unlimited	Unlimited	500
Account code structure (characters)	30 alpha-numeric	15 alpha-numeric	5-6 numeric	12 alpha-numeric	3 numeric
Features and functions					
Maximum number of companies	Unlimited	65,535	Unlimited	Unlimited	Unlimited
Maximum number of subaccounts	Unlimited	65,535	99 departments	10	999
Maximum number of journal entries	Unlimited	9,999	Unlimited	Unlimited	Unlimited
Automatic reversing entries	☒	☐	☒	☐	☐
Automatic recurring entries	☒	☒	☒	☒	☐
Consolidations	☒	☒	☒	☐	☐
Suspends processing of unbalanced amount	☐	☐	☒	☒	☐
Enters next year's budget during current year	☐	☐	☒	☒	☐
Performs standard monthly allocations	☐	☒	☒	☐	☐
Reports					
Statements of cash flow	☒	☒	☐	☒	☐
User-defined balance sheet	☒	☒	☒	☒	☐
User-defined income statement	☒	☒	☒	☒	☐
Reports by journal type	☒	☒	☒	☒	☒
INVENTORY					
Program parameters					
Maximum number of inventory items	Unlimited	65,535	Unlimited	Unlimited	499
Inventory item code structure (characters)	14 alpha-numeric	15 alpha-numeric	15 alpha-numeric	10 alpha-numeric	3 numeric
Features and functions					
Year-to-date cost of sales	☒	☒	☒	☒	☐
Substitute part number	☒	☐	☐	☒	☐
Dual units (purchasing and selling)	☒	☒	☒	☐	☐
Committed quantity	☒	☒	☒	☐	☐
Last sale date	☒	☒	☒	☐	☐
Multiple vendors for same item	☒	☒	☐	☒	☒
Inventory costing :					
Average cost	☒	☒	☒	☒	☒
Standard cost	☒	☒	☒	☒	☐
LIFO/FIFO	☐	☒	☒	☐	☐
Specific	☒	☒	☒	☒	☐
Number of price levels	3	6	3	1	1
Discount percents and quantities	☒	☒	☒	☐	☐

■—Yes □—No

CONTINUES

We'll take your stats and make you the most valuable player in your league.



March 14, 1989



CHRIS JOHNSON
Data Analyst

CHRIS JOHNSON Data Analyst

CAREER HIGHLIGHTS:

1983
Proposed remap of sales territories based on SPSS analysis of economic and consumer trends. Increased new-customer revenues 38% in 2 years.

1985
Used SPSS data entry/tabulation system to administer employee benefits more efficiently. Eliminated outside costs of more than \$75,000.

1986
Identified current customers likely to need added services, increasing average billings by more than 20%.

1988
Rewarded with special corporate recognition and bonus.

Another Story in the **SPSS SUCCESS SERIES**

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With SPSS and its options, you can interface directly with data from your database, spreadsheet or other

application software. Then manipulate it in countless ways. From data entry to advanced statistics, forecasting, presentation and more.

Voted #1 by the fans.

When the readers of *PC Week* chose the top statistical software for "user satisfaction" (12/5/88), their choice was SPSS. And no wonder.

SPSS is designed not only for your computer's operating system, but also for its operator. With menu and help systems, plus an on-line statistical glossary. So you're always in control. For market research, sales analysis, quality control and more.

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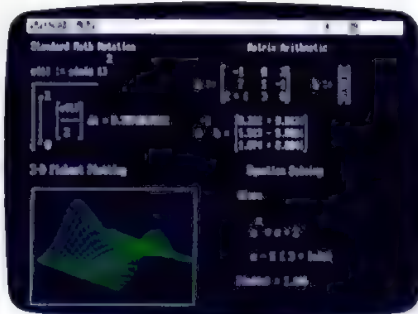
CIRCLE 103 ON READER SERVICE CARD

After centuries of practice, mankind perfects engineering calculations: MathCAD.

Announcing MathCAD 2.5: The Dawn of a New Age.

What the historians will call it, only time will tell.

Perhaps the Century of Speed, or the Era of Ease. But whatever the name, this is the age of MathCAD 2.5, the only math package that looks and works the way you think.

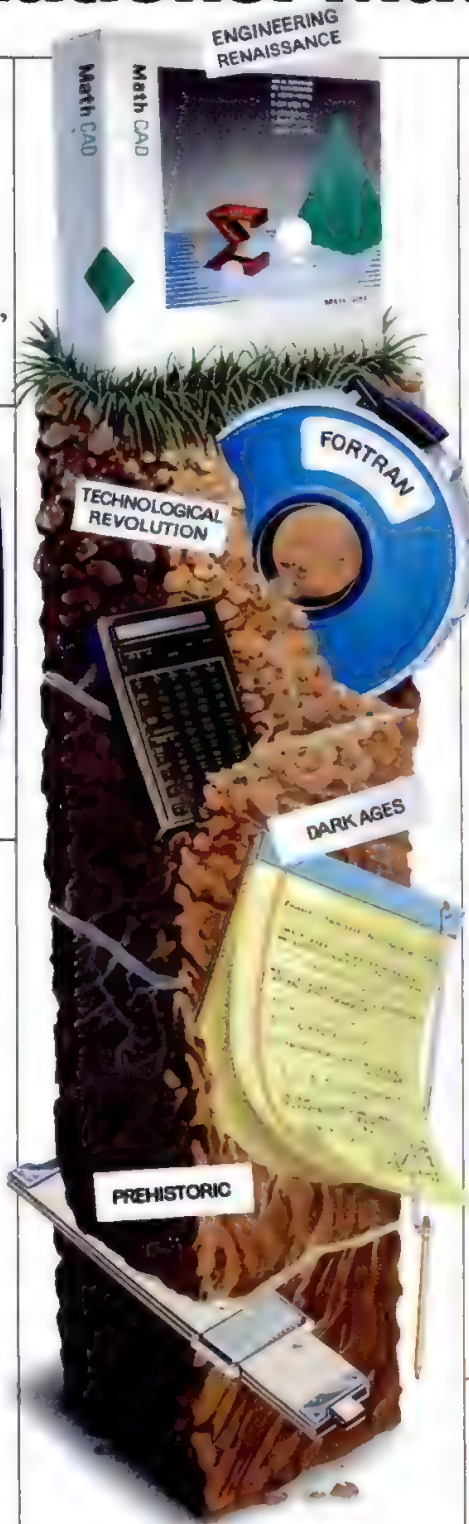


MathCAD 2.5 includes 3-D plotting, HPGL sketch import, and PostScript output.

MathCAD is far and away the best-selling math package in the world. Because it lets you perform engineering and scientific calculations in a way that's faster, more natural and less error-prone than the way you're doing them now—whether you're using a scratchpad, calculator, spreadsheet or program that you wrote yourself.

And now we've made the best even better. MathCAD 2.5 is a dramatically improved version that includes three-dimensional plotting, enhanced numerical analysis, and the ability to import HPGL files from most popular CAD programs, including AutoCAD.* And now you can print on PostScript* compatible printers.

And like before, MathCAD's live document interface™ lets you enter



equations anywhere on the screen, add text to support your work, and graph the results. Then print your analysis in presentation-quality documents.

It has over 120 commonly used functions built right in, for handling equations and formulas, as well as exponentials, differentials, cubic splines, FFTs and matrices.

No matter what kind of math you do, MathCAD 2.5 has a solution for you. In fact, it's used by over 60,000 engineers and scientists, including electrical, industrial, and mechanical engineers, physicists, biologists, and economists.

But don't take our word for it; just ask the experts. PC Magazine recently described MathCAD as "everything you have ever dreamed of in a mathematical toolbox."

And for Macintosh* users, we present MathCAD 2.0, rewritten to take full advantage of the Macintosh interface. Entering operators and Greek letters into equations is pure simplicity!

Look for MathCAD 2.5 at your local software dealer, or give us a call. For more information, a free demo disk, or upgrade information, dial 1-800-MATHCAD (in MA, 617-577-1017).

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TM and ® signify manufacturer's trademark or manufacturer's registered trademark respectively.

MathCAD®

MathSoft, Inc. One Kendall Square, Cambridge, MA 02139



LOW-END ACCOUNTING SOFTWARE: SUMMARY OF FEATURES

Products listed in ascending price order

	DacEasy Accounting	Act 1	Peachtree Complete III	ProfitWISE	Bedford Integrated Accounting
INVENTORY					
Markup pricing for range of goods	☐	☐	☒	☒	☐
Fractional pricing	☒	☒	☒	☐	☒
Standard unit of measure of conversion	☐	☒	☒	☐	☐
Parts list or component capability (BOM)	☒	☒	☒	☐	☐
Transfers between warehouses	☐	☒	☐	☒	☐
Alternate vendor info	☒	☒	☐	☒	☐
Reports					
Inventory price list	☒	☒	☒	☒	☒
Serial-number aging report	☐	☐	☒	☐	☐
Inventory turnover trend reporting	☒	☒	☒	☐	☐
Inventory sales history	☒	☒	☒	☒	☐
Inventory activity	☒	☒	☒	☒	☐
Inventory commitment	☒	☒	☒	☐	☐
SYSTEM FEATURES					
Reporting privileges defined by password	☒	☐	☒	☒	☐
Maximum characters per password	8	8	8	12	3
Reports					
User names with passwords	☐	☐	☐	☒	☐
Application manager					
Supports point-of-sale terminals	☐	☒	☒	☐	☐
Pages up and down through on-screen reports	☒	☐	☒	☒	☒
User-defined options on each menu	☐	☐	☒	☐	☐
Context-sensitive help screens	☒	☐	☒	☒	☒
System manager					
Imports data	☒	☒	☐	☐	☐
Reads/writes delimited ASCII files	☒ / ☒ (GL only)	☒ / ☒	☐ / ☒	☐ / ☒	☐ / ☒
Reads/writes .SDF ASCII files	☐ / ☐	☒ / ☒	☐ / ☒	☐ / ☒	☐ / ☐
Reads/writes .DBF files	☐ / ☐	☒ / ☒	☐ / ☒	☐ / ☐	☐ / ☐
Reads/writes .WK? files	☐ / ☐	☐ / ☐	☐ / ☒	☐ / ☒	☐ / ☒
Mailing labels	☒	☒	☒ (with PDQ, \$99.00)	☒	☒
Program modification					
Source code available	☐	☒	☒	☐	☐
Vendor will modify source code	☐	☒	☐	☐	☐
Developers' guide available (integrated third-party software)	☐	☒	☒	☐	☐
MODULES					
Included	GL, AR, AP, OE, I, P, CRW	GL, AR, AP, OE, I, P, PR	GL, AR, AP, OE, I, P, PR, FA, JC	GL, AR, AP, OE, I, PR, FA, JC	GL, AR, AP, I, PR
Optional cost	PR, \$99.95	JC, \$199.50; CRW, \$199.50; Fund 1, \$199.50	CRW, \$100.00; PDQ, \$99.00	Graphics and CRW, \$199.00	Graphics and CRW, \$129.00
TECHNICAL SUPPORT					
Toll-free number available	☒	☒	☒	☐	☐
Technical support fee	\$75 per hour	\$75 per hour	\$1 per minute	\$95 per hour	\$100 per hour
TRAINING					
Training classes at various locations	☒	☒	☒	☒	☐
Training manuals	☒	☒	☒	☒	☒
On-line tutorials	☒	☐	☒	☒	☒
Video training	☒	☐	☒	☐	☐
CAPACITIES					
Maximum number of open months	19	14	1	13	12
Maximum number of fiscal periods	13	13	13	13	365
Number of periods detail is maintained	19	15	12	12	1 fiscal year
Transaction limit	\$99 million	\$100 million	\$99 million	\$99 million	\$20 million
Database size	Unlimited	65,535 records	Unlimited	5MB	N/A

■—Yes □—No

N/A—Not applicable: the product does not have this feature.

GL = General Ledger, AR = Accounts Receivable, AP = Accounts Payable, OE = Order Entry, I = Inventory,

P = Purchasing, PR = Payroll, FA = Fixed Assets, JC = Job Costing, CRW = Custom Report Writer,

LIFO = Last In First Out, FIFO = First In First Out.

ENDS



FACT FILE

Bedford Integrated Accounting, Version 3.3

Computer Associates International Inc., 1240 McKay Dr., San Jose, CA 95131; (800) 531-5236, (408) 432-1727.

List Price: \$249;

AccPac Bedford Graphic & Custom Reporting, \$129.

Requires: 384K RAM, DOS 3.0 or later.

In Short: Bedford's ease of use makes it ideal for the first-time computer user or accountant. Those who are further along on the learning curve, however, may find Bedford lacking in features.



CIRCLE 387 ON READER SERVICE CARD

hand and decreases the inventory. You can display or print any customer's sales history, including an aging of his receivables.

To accelerate cash receipts processing, *Bedford* automatically applies payments to the oldest invoices first. You can, at your discretion, override this feature and apply payment to any invoice.

The Accounts Payable module not only performs the basic accounts payable functions, such as printing checks and tracking vendor balances, but also updates your inventory quantities and costs when invoices are entered. This simple approach eliminates the need to enter inventory receipts data into the inventory module.

The system permits manually produced checks and allows the reprinting of checks if your printer malfunctions. Because *Bedford* does not capture invoice due dates, you must display all invoices for each vendor and individually select those invoices to be paid. You can maintain invoice histories for one or more vendors.

The Accounts Receivable module is not without its limitations. The system does not allow for voided checks and does not print 1099s. When setting up the AR module, you may enter only a single sales tax rate, accounts receivable, and cash account number. As in Accounts Payable, the system does not track terms, discounts, or credit limits.

The majority of transactions that affect *Bedford*'s Inventory module originate from either the Accounts Receivable (sales) or Accounts Payable module (purchases). The only transactions entered directly into Inventory are quantity adjustments or General Ledger account transfers.

As with customer and vendor numbers,

PRICE WATERHOUSE REPORT

LOW-END ACCOUNTING

Bedford assigns sequential inventory numbers to items as they are initially entered. All items are valued using the average-cost method based upon purchase price. Users set the sales price on an item-by-item basis. For reporting purposes, *Bedford* al-

lows you to define the sales:cost ratio as either a markup or a margin. This permits different businesses—retail versus wholesale, for example—to view data in the preferred format.

The fully integrated Job Cost module tracks expenses and revenues for special projects or "jobs." In all transaction

QUICKEN AND MONEY MATTERS: Good Bets for the Less-Complicated Workplace

by Lee Thé

Even these under-\$250 double-entry accounting packages may be more than some companies really need. Many cash-based businesses now being run with only a checkbook can turn to *Quicken*, Version 3.0, Intuit's best-selling checkwriter/financial manager (see September 26, 1989 review, page 46). This \$59.95 program was the first to make computerized bill paying faster than doing it by hand.

Though *Quicken* started out as home finance software, it has been revised to have greater business capabilities. Version 3.0 makes it easier to maintain multiple accounts and to transfer funds, categorize expenses, reconcile checks, put memos on checks, distribute each check's total into multiple categories, manage credit cards, and track assets, liabilities and cash.

Quicken's interface simulates familiar paper checks and check registers, and getting started barely requires the manual. You can use the register by itself as a check tracking system, or have *Quicken* write checks as well.

This package stands out in its ability to produce a variety of standard reports, including a useful cash flow statement, tracking of receivables and payables, profit and loss, income, and balance sheets. Reports can be organized by job, client, project, property, or department.

Until recently, those who needed more than *Quicken* were advised to move all the way up to a double-entry accounting package. But *Money Matters*, Great American Software's new \$89.95 single-entry package, bridges the gap. Rather than being developed from a home finance package, *Money Matters* was designed from scratch for

small businesses with 1 to 5 employees. Its ease of use does not match *Quicken*'s, but *Money Matters* accomplishes more. For example, it lets you choose from 14 different charts of accounts for different kinds of businesses, versus one for *Quicken*.

Most people buy accounting packages with receivables in mind first. Accordingly, *Money Matters*' invoicing function expedites billing by offering the user a choice of formats and a macro facility.

Security counts, too, and this program has a real audit trail—highly desirable if anyone other than you will be tagged with the task of cranking numbers through the package. In contrast, someone can delete transactions at will in *Quicken* and evade full transaction reconciliation.

Money Matters handles distributions more fluidly as well. You use two-digit department fields rather than stacked category names. The latter looks easy but becomes cumbersome as your business becomes more elaborate.

Small business owners want firm controls but great adaptability to their business. Inexpensive accounting packages tend to be rigid little bricks, but *Money Matters* allows you to do some molding. For instance, you can change the program's default terminology and tell it to call customers "clients." Changes automatically ripple through reports and input screens.

If you're up to an added layer of complexity, you can use the optional SuperTracker, a user-definable pop-up window that lets the system capture business-specific data and create reports incorporating that data. For example, contractors could track hours and costs for each phase of a job. Retailers

PRICE WATERHOUSE REPORT

LOW-END ACCOUNTING

screens, simply specify to which job the transaction is related and it will be applied automatically. Furthermore, you can enter a minimum stock level for each item to assist you in minimizing back orders. A stock-level report can be printed on demand, indicating the current inventory level and safety stock level for each item.

Flexible checkwriting features in Great American's *Money Matters* make it ideal for the less-complicated business. For example, *MM* lets you distribute any check's amount among several categories so that you can manage your inventory while you write your checks.

DATE		PAID TO		CHECK	CHECK	Checking account	
LINE #	MEMO	NUMBER	AMOUNT				
12/15/90	Breery Advertising	1093	M	000 07		Kite Materials	5010 00
4	Brochures					Advertising	5100 00
12/15/90	Electric Company	1094	M	70 90			
5	Heat						

Enter the amount or quantity requested. Press F10 to save. ESC = Cancel.

F1 Help F2 Edit F3 F4 List F5 F6 F7 Prev F8 Next F9 F10 Save

could track income and expenses by inventory item. In fact, you could do better job costing than some double-entry systems allow, including Computer Associates' *Bedford Integrated Accounting* (reviewed in this roundup).

Otherwise, reporting falls a bit short of that in *Quicken*, which provides spreadsheet output and allows greater alteration of standard reports.

Quicken is faster than *Money Matters*, courtesy of working in RAM. *Money Matters* goes the other way. It can hold records for up to 99 companies, keep 500 invoices and as many accounts. At the end of your tax year you'll appreciate its ability to keep the year open for three months.

If you anticipate company growth that is large enough to demand more complexity than *Money Matters* can handle, start with *Money Matters* and

later move up to Great American's popular *One-Write Plus* double-entry, accrual-based package (see the sidebar "How Big Is Your Business?"). It uses the same interface and data as *Money Matters*, making changeover a snap.

Money Matters and *Quicken* aim at different kinds of buyers and businesses. Each provides fiscal satisfaction for a miserly sum, and at least one of them—*Money Matters*—can prepare you for the wide world of double-entry accounting packages.

Quicken, Version 3.0, Intuit Inc., P.O. Box 3014, Menlo Park, CA 94026; (800) 624-8742 (orders only), (415) 322-9543. **List Price: \$59.95.**

CIRCLE 401 ON READER SERVICE CARD

Money Matters, Version 1.0, Great American Software, 615 Amherst St., Nashua, NH 03063; (603) 889-5400. **List Price: \$89.95.**

CIRCLE 402 ON READER SERVICE CARD

Bedford Integrated Accounting is an easy-to-use, reasonably priced option for computer users with limited bookkeeping or computer experience. But if your requirements do increase, Computer Associates will gladly provide you, free of

charge, with a bridge to convert your data directly to its more sophisticated *AccPac BPI* or *AccPac Plus*. Even so, the ease-of-use distinction between this and more-elaborate packages is starting to blur with the advent of accounting systems sporting graphical user interfaces. For a sneak preview, take a look at *Bedford Simply Accounting* for the Macintosh. We wouldn't be surprised if *Bedford's* next PC package looked a lot like it.

DacEasy Accounting

by Raymond A. August
and Danette F. Quiring

With the introduction of *DacEasy 4.03*, *DacEasy* has produced a truly innovative accounting package. For \$149.95, you receive a fully integrated accounting system complete with Cash, Accounts Payable, Accounts Receivable, Billing, Purchase Order, Inventory, Report Writer, and General Ledger modules. With a LAN version on the way, *DacEasy* holds a lot of promise for the future.

DacEasy's excellent interface is easy to use with either a keyboard or mouse. Version 4.0, which uses Novell's *Btrieve* file-handling system, allows for processing multiple companies, on-line inquiry for nearly every field, the elegant management of cash transactions, product assembly, the updating of master files from transaction-level input screens, and many other new features. Moreover, Version 4.03 includes graphics and a report generator—previously available only as separate packages.

The new interface departs from the typical General Ledger, Accounts Payable, Accounts Receivable menuing structure. Main menu categories are distinguished as File, Edit, Transaction, Journal, Posting, Reporting, and Periodic.

DacEasy's audit trail is effective, with one major exception: *DacEasy* not only lets you operate in an out-of-balance condition, but its manual tells you how to get there. The manual shows you how to defeat the normal balancing process central to double-entry accounting by simply pressing F7 after entering an out-of-balance balance. Still, *DacEasy* will not allow you to post transactions until you perform all preliminary steps. For instance, in Accounts Receivable, you must enter invoices, print the invoices, print journal reports, and then post transactions.

April 1st is funny.



Adobe Systems ... NCP

☐ **Streamline Windows 1.0**—Converts your bitmapped images to PostScript format. Imports TIFF, PNT, and PCX formats. Exports to EPS, Illustrator, Corel Draw and Micrografx Designer. \$229.

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Adobe Systems ... NCP		
6591	☐Illustrator Windows 1.0	\$279.
6590	☐Streamline Windows 1.0	229.
Aldus ... NCP		
1332	☐PageMaker 3.0	499.
Alpha Software ... NCP		
5104	☐Alpha Four 1.1	319.
4103	☐Alpha Works 2.0	89.
Application Techniques ... NCP		
1214	☐Pizazz Plus 1.3	69.
Ashton-Tate ... NCP		
4450	☐dBASE IV 1.0	499.
Autodesk ... NCP		
4519	☐Autosketch 2.0	95.
6119	☐Autosketch Animator 1.0	189.
Avery ... NCP		
6006	☐Label Pro 1.0	49.
Bitstream ... NCP		
☐Fundamentals:		
Reports and Proposals, Presentations		
or Spreadsheets		
	each	159.
	☐Headlines (1 to 6)	each 99.
	☐Individual Fonts	each 99.



Alpha Software ... NCP

☐ **Alpha Four 1.1**—The award-winning, fully relational database management & application development system for business people, not programmers. Offers sophisticated reports and customized applications. \$319.

Bloc Publishing ... NCP		
1447	☐FormTool 2.01	55.
6245	☐PopDropPLUS 1.0	59.
Borland International ... NCP		
4330	☐Turbo C Professional Pack 1.0	175.
4332	☐Turbo Pascal Professional Pack 1.0	175.
6242	☐Quattro Pro 1.0	289.
1514	☐Paradox 3.0	469.
Brightbill-Roberts ... NCP		
5408	☐Hyperpad 1.0	89.
5843	☐Show Partner F/X 3.5	229.
Broderbund ... CP		
1434	☐New Print Shop (NCP)	39.
1433	☐Memory Mate 3.01 (NCP)	45.
ButtonWare ... NCP		
6419	☐PC-File 5.0	75.
Caere ... NCP		
6004	☐OmniPage 386 2.1	599.
Central Point ... NCP		
5039	☐PC Tools Deluxe 5.5	77.
5038	☐Copy II PC 5.0	27.

Chipsoft ... NCP		
1663	☐TurboTax for 1989 Taxes 7.0	\$45.
	☐Individual States	each 34.
Chronos Software ... NCP		
4387	☐Who•What•When 1.09	119.
Concentric Data Systems ... NCP		
6575	☐R & R Relational Report Writer 3B	109.
Corel Systems ... NCP		
5506	☐Corel Draw 1.1	329.
Crosstalk Communications ... NCP		
2908	☐Crosstalk XVI 3.7	109.
5611	☐Crosstalk for Windows 1.0	129.
DacEasy ... NCP		
1748	☐DacEasy Accounting 4.0	89.
Data Storm ... NCP		
4798	☐PROCOMM PLUS 1.1	52.
Delrina Technology ... NCP		
4325	☐PerFORM 2.0	169.
Delta Technology ... NCP		
5829	☐Direct Access 4.1	52.
Digital Composition Systems ... NCP		
5876	☐db Publisher Report Maker 2.0	185.
Dow Jones ... NCP		
5494	☐News/Retrieval Membership Pkg.	24.
5th Generation ... NCP		
2762	☐Mace Utilities 1990	89.
3950	☐Fastback Plus 2.09	109.
FormWorx ... NCP		
5810	☐FormWorx with Fill & File 2.5	85.
Fox Software ... NCP		
6188	☐FoxPro 1.0	489.
2233	☐Foxbase Plus 2.1	199.
Funk Software ... NCP		
2228	☐Sideways 3.21	42.
4479	☐Allways 1.0	85.
Generic Software ... NCP		
2265	☐Generic CADD Level 3 1.13	169.
Great American Software ... NCP		
4880	☐One Write Plus Accounting Sys. 2.0	179.
5825	☐Money Matters 1.0	55.
Harvard Associates ... NCP		
2324	☐PC Logo 3.0	59.
Hayes ... NCP		
2293	☐Smartcom II 3.0	89.



Microcom ... NCP

☐ **Carbon Copy Plus 5.2**—Links two PCs, their keyboards, screens, and disks. You can have complete control of a remote PC's application software from your own PC. \$115.

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Hilgraeve ... NCP	
2323	HyperACCESS 5.1.0 (DOS & OS/2) \$115.
IBM ... NCP	
6187	Storyboard Plus 2.0 239.
6599	Current 1.0 239.
Individual Software ... NCP	
2408	Professor DOS 4.0 27.
6222	Resume Maker 1.0 29.
Intuit ... NCP	
2426	Quicken 3.0 39.
Lord Publishing ... NCP	
5191	Ronstadt's Financials 1.02 145.
Lotus ... NCP	
5417	1-2-3 3.0 call
5653	1-2-3 2.2 call
5134	Magellan 1.0 149.
4131	Agenda 1.0 275.
2660	Freelance Plus 3.01 345.
MECA ... NCP	
4603	Andrew Tobias' Tax Cut 1989 45.
2798	Managing Your Money 6.0 119.
Microcom ... NCP	
2775	CarbonCopy Plus 5.2 (2 req.) ... 115.
Micrografx ... NCP	
6294	Draw Plus 1.0 289.
Micro Logic ... NCP	
2968	Tornado 1.8 55.
Microlytics ... NCP	
2731	GOfar 2.0 (new version) 45.
Microsoft ... NCP	
2860	Learning DOS 2.0 35.
2899	Windows 286 2.1 69.
2904	Works 2.0 99.
2900	Windows 386 2.1 129.
2901	Word 5.0 209.
6195	Word for Windows 329.
2856	Excel 2.1 (req. 80286/80386) ... call
6133	Excel for OS/2 1.0 339.
5188	QuickPascal 1.0 69.
2894	QuickBASIC 4.5 69.
2895	QuickC 2.0 69.
2853	C Compiler 5.1 299.
Multisoft ... NCP	
4925	PC-Kwik Power Pak 1.5 79.

New England Software ... NCP	
4337	GB-Stat 1.5 \$159.
Noio Press ... NCP	
2982	WillMaker 3.0 35.
Norton-Lambert ... NCP	
4928	Close-Up Customer 3.0 135.
4929	Close-Up Support 3.0 165.
5420	Close-Up Lan (8 user) 529.
Paperback Software ... NCP	
6358	VP-Planner 3D 1.0 169.
PC Globe ... NCP	
5902	PC Globe 3.0 39.
5900	PC USA 1.0 39.
Personics ... NCP	
3126	SeeMORE 2.0 54.
4328	Look & Link 1.1 59.
Peter Norton ... NCP	
3152	Norton Commander 3.0 89.
3146	Advanced Utilities 4.5 89.
6397	The Norton Backup 1.0 89.
Precision Software ... NCP	
6600	Superbase 4 for Windows 459.



Quarterdeck ... NCP
☐ **GRAM 1.0**—Manage your memory to it's fullest with QRAM. If you have an EMS 4.0 or EEMS board, QRAM can use it to free up more memory within the 0—640k area. \$49.



Norton-Lambert ... NCP
 Award-winning Close-Up connects two PCs via modem, linking screens & keyboards. Ideal for remote support & training.
☐ **Close-Up Customer/Terminal 3.0** \$135.
☐ **Close-Up Support/ACS 3.0** 165.

Samna ... NCP	
5799	Ami Professional 1.0 319.
Softlogic Solutions ... NCP	
3546	Disk Optimizer 4.05 45.
3542	Software Carousel 3.01 55.
Softview ... NCP	
3474	MacInTax for Windows (1989 taxes) 65.
Software Publishing ... NCP	
6289	Draw Partner 1.0 59.
3499	PFS:First Publisher 2.1 89.
3478	PFS:First Choice 3.02 105.
3496	Professional Write 2.12 149.
3493	Professional File 2.01 199.
3482	Harvard Graphics 2.13 339.
Symantec ... NCP	
3427	Q&A Write 1.01 139.
3425	Q&A 3.0 229.
3431	Timeline 3.0 399.
Systems Compatibility ... NCP	
6568	Word Exchange 4.0 55.
6564	Software Bridge 4.1 79.



ButtonWare ... NCP
☐ **PC-File 5.0**—The most friendly, comprehensive database available. It includes letter-writing with mail merge, business graphing, and a powerful report writer. It also works directly on dBase files \$75.

Quarterdeck ... NCP	
3221	Expanded Memory Mgr. 386 5.0 59.
3220	DESQView 2.26 79.
4586	DESQView 386 129.
6400	Manifest 1.0 39.
6422	QRAM 1.0 49.
Reality Technologies ... NCP	
6572	WealthBuilder 1.1 145.
Reference Software ... NCP	
4396	Grammatik IV 1.0 52.
Revolution Software ... NCP	
4480	VGA Dimmer 2.01 (screen saver) . 19.
RightSoft ... NCP	
4155	RightWriter 3.1 54.

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Software Publishing ... NCP
☐ **Harvard Graphics 2.13**—Be "free and easy" with the industry's best-selling presentation graphics package. Now includes Draw Partner drawing accessory FREE (normally \$149 List). Graphically the best choice \$339.

We've got what it takes



Timeslips ... NCP

□ *Timeslips III 3.4*—Track every minute's efforts, then print the invoice and log the receivable all from the convenience of Timeslips III. Menu-driven and memory resident, this is a must for your service business. \$169.

Timeslips ... NCP

- 2987 □ *Timeslips III 3.4* 169.
Timeworks ... NCP
 6253 □ *Publish-It! 1.1* 115.
TOPS ... NCP
 3726 □ *TOPS Network Bundle 3.0* 159.
 3720 *Flashcard 2.1 (AppleTalk network card; 1 year warranty)* 179.
Traveling Software ... NCP
 4190 *Battery Watch 2.0 (3 1/2" only)* 35.
 5179 □ *LapLink III 3.0* 85.
True BASIC ... NCP
 3561 □ *True BASIC 2.1* 52.
Vericomp ... NCP
 3765 □ *SoftBytes 2.0* 35.
WordPerfect Corp. ... NCP
 3799 □ *WordPerfect Library 2.0* 75.
 3804 □ *WordPerfect 5.1* 265.
WordStar USA ... NCP
 2825 □ *WordStar Prof. Release 5.5* 229.
 5000 □ *Upgrade to Release 5.5* 89.



Reality Technologies ... NCP

□ *WealthBuilder by Money Magazine 1.1*—Save & invest wisely. Set financial goals & achieve them. Plan for retirement, a child's education, a home. Optimize your portfolio & track all of your investments \$145.

Xerox ... NCP

- 3812 □ *Ventura Publisher 2.0* \$529.
 6505 □ *Formbase 1.0* 319.
XTREE ... NCP
 6161 □ *XTreePro Gold 1.3* 75.
XYQUEST ... NCP
 4393 □ *XyWrite III Plus 3.55* 229.

RECREATIONAL/EDUCATIONAL

Broderbund ... CP

- 1417 □ *Where/Europe Carmen Sandiego?* 32.
 5701 □ *Where/Time Carmen Sandiego?* ... 32.

Electronic Arts ... NCP

- 6436 □ *Hunt for Red October* 35.
 4659 □ *Chessmaster 2100 (CP)* 35.
 5804 □ *Deluxe Paint II (Enhanced)* 89.

Microprose ... CP

- 4454 □ *F-19 Stealth Fighter* 39.
 5823 □ *Red Storm Rising* 39.

Microsoft ... NCP

- 2858 □ *Flight Simulator 4.0* 39.



Microsoft ... NCP

□ *Word for Windows*—Combines the power of Word for the PC with ease of use and WYSI-WYG accuracy of Microsoft Windows. Integrate graphics and data from Windows applications into your documents. \$329.

Parlor Software ... CP

- 3159 □ *Bridge Parlor 2.3* 49.

Sierra On-Line ... CP

- 6023 □ *Leisure Suit Larry III* 39.
 5695 □ *Manhunter: San Francisco* 33.
 4456 □ *Police Quest II* 39.
 5106 □ *Space Quest III* 39.
 6022 □ *Colonel's Bequest* 39.

Spectrum Holobyte ... NCP

- 5993 □ *Welltris (Tetris sequel)* 22.

Spinnaker ... CP

- 5580 □ *Sargon IV* 32.

Stone & Assoc. ... NCP

- 3435 □ *My Letters, Numbers, Words (2 to 6)* 22.
 3438 □ *1st Math (ages 5 to 8)* 22.
 3439 □ *2nd Math (ages 7 to 16)* 27.
 5231 □ *Phonics Plus* 22.

Sublogic ... NCP

- 6190 □ *Air Transport Pilot* 33.

True BASIC, Inc. ... NCP

- *Kemeny/Kurtz Math Series:*
 10 titles each 45.



Intel ... 5 years

Connection CoProcessor—Award winning fax-modem includes a free copy of Fax-it software from Intel. Send and receive information in the background from within many popular applications. New low price \$529.

HARDWARE

Manufacturer's standard limited warranty period for items shown is listed after each company name. Some products in their line may have different warranty periods.

AST Research ... 2 years

- 1299 *SixPakPlus 384k C/S/P* 189.
 4107 *RAMPage Plus 286 512k* 419.

Brother International ... 1 year

- 5787 *HL-8e Laser Printer* 1799.
 5788 *HL-8Ps PostScript Laser Printer* . 2949.

Compuable ... 2 years

- 1604 *2-Position switch box* 25.
 1605 *3-Position switch box* 35.

Corvus ... 1 year

- 6184 *ReadyNet Starter Kit* 319.
 6183 *ReadyNet Add-On Kit* 165.

Cuesta ... 1 year

- 1608 *Datasaver 400 Watt (power backup)* 429.

Curtis ... lifetime

- 1690 *Diamond Plus SP-1 +* 41.
 1694 *Emerald SP-2* 36.
 1707 *Ruby SPF-2 (6 outlets)* 55.
 1708 *Ruby-Plus SPF-2 Plus* 65.

Diconix ... 1 year

- 5655 *150 Plus Printer (Parallel)* 359.

Epson ... 1 year

We are an authorized Epson Service Center.

- 1906 *FX-850 (80 col., 264 cps, 9 pin)* . 369.
 1904 *FX-1050 (136 col., 264 cps, 9 pin)* . 479.
 5183 *LQ-510 (80 col., 180 cps, 24 pin)* . 349.
 1930 *LQ-850 (80 col., 264 cps, 24 pin)* . 519.
 1917 *LQ-1050 (136 col., 264 cps, 24 pin)* 725.
 4116 *LQ-2550 (136 col., 333 cps, 24 pin)* 989.
 5184 *LX-810 (80 col., 180 cps, 9 pin)* . 199.
 1052 *Printer-to-IBM cable (6 feet)* 15.

5th Generation ... 1 year

- 3952 *Logical Connection 512k* 529.

Hayes ... 2 years

- 2307 *Smartmodem 2400* 349.
 2308 *Smartmodem 2400B (w/Smartcom II)* 249.

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to make the best of both.



Intel ... 5 years

2400EX MNP Modem—The newest member of Intel's modem family. MNP/Level 5 provides error-correction for reliable communications, as well as data compression for faster data throughput \$229.

Hercules ... 2 years

2318 Graphics Card Plus 189.

Hewlett-Packard ... 1 year

6583 Laserjet II (w/toner) 1739.

6582 Laserjet IIP (w/toner) 1039.

6581 Deskjet Plus (w/link cartridge) 719.

Intel ... 5 years

4696 2400B Internal Modem 159.

2352 2400B Internal Modem 2 (for PS/2) 249.

5119 2400 Baud External Modem 179.

6420 2400EX MNP Modem 229.

2346 Inboard 386/PC w/1 Meg (w/free Arm) 579.

4266 Above Board Plus 512k 419.

4267 Above Board Plus I/O 512k 449.

5336 Above Board Plus 8 2 Meg 599.

5342 Above Board Plus 8 I/O 2 Meg 629.

4272 Above Board 2 Plus 512k 469.

5396 Above Board MC 32 0k 359.

4275 Connection CoProcessor (w/Fax-it) 529.

4857 Visual Edge (graphics enhancement for the HP LaserJet II) 449.

MATH COPROCESSORS

2370 80287-8 (for 8 MHz 80286 CPU's) . 199.

2369 80287-10 (for PS/2 Models 50 & 60) 229.

4750 80387SX (for 80386SX CPU's) . 309.

2371 80387 (for 16 MHz 80386 CPU's) . 349.

2372 80387-20 (for 20 MHz 80386 CPU's) 399.

Kensington Microware ... 1 year

2582 Masterpiece Plus 109.

5697 Expert Mouse (Trackball for PS/2) . 115.

Key Tronic ... 3 years

4518 101 Plus Keyboard 99.

Kraft ... 5 years

5801 New Game Adapter (2 game ports) . 27.

5800 3 button Thunder Joystick 29.

5802 Trackball 69.

Logitech ... limited lifetime

5464 Series 2 Mouse (C9 for PS/2's) . 69.

5151 HiREZ Mouse (C9) 85.

6029 Trackman (Trackball) serial 85. bus 89.

4297 ScanMan Plus (hand scanner) . 185.

Micron Technology ... 2 years

6005 Ascend 4 Meg Brd. for Compaq 386 699.

6013 Beyond Mem. Brd. for Model 50 (512k) 359.

Microsoft ... lifetime

2897 Mouse with Paintbrush \$109.

2898 Mouse with Windows 286 2.1 139.

MicroSpeed ... 1 year

6007 PC-TRAC Trackball serial 75. bus 85.

6010 FastTRAP 3D Trackball serial 99. bus 109.

Mouse Systems ... lifetime

5845 White Mouse (bus or serial) 69.

5997 Trackball (1 yr. wrnty.) serial 75. bus 85.

4306 PC Mouse II w/PC Paint+ 89.

NEC ... 2 years

4799 Multisync 2A (VGA Monitor) 499.

5085 Multisync 3D Monitor 689.

Orchid Technologies ... 4 years

4690 ProDesigner VGA (800 x 600) 249.

PC Power & Cooling Sys. ... 1 year

REPLACEMENT POWER SUPPLIES

3202 Turbo Cool 150 (25° - 40° cooler) 129.

3200 Silencer 150 (84% noise reduction) 115.



Hilgrace ... NCP

HyperACCESS/5.1.0—Blasts data through your modem faster than any other program. Potent, agile, civilized. An automation breakthrough ... it learns your work! Contains versions for DOS and OS/2. \$115.

Practical Peripherals ... 5 years

3101 1200 Baud Internal Modem 69.

3100 1200 Baud External Modem (mini) . 77.

3103 2400 Baud Internal Modem 139.

3102 2400 Baud External Modem 179.

5286 2400 Baud Int. MNP Modem (Lex. 5) 175.

5285 2400 Baud Ext. MNP Modem (Lex. 5) 209.

4542 2400 Baud Internal Modem for PS/2 . 229.

Safe Power Systems ... 2 years

4561 Safe 250W (standby power bkup) 249.

4562 Safe 425W (standby power bkup) 369.

SOTA Technology ... 2 years

5111 SOTA 286i-12 (12 MHz accelerator) 269.

5402 SOTA 386i-16 (16 MHz accelerator) 389.

Targus ... lifetime

4899 Nylon Laptop carrying case 55.

6037 Premier leather carrying case 199.

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TheComplete PC ... 2 years

TheComplete Communicator—It's a 9600 bps fax. It's a 2400 bps modem. It's a sophisticated voice messaging and processing system. It's a scanner port. It's TheComplete solution! \$559.

TheComplete PC ... 2 years

5598 TheComplete Half Pg. Scanner 400 189.

5140 TheComplete Page Scanner 549.

4887 TheComplete Fax 9600 429.

5828 TheComplete Communicator 559.

Toshiba ... 1 year

3684 T1000 Laptop (80C88, 6.4 lbs.) . 669.

6332 T1000SE Notebook Laptop (5.9 lbs.) 1269.

4958 T1600 Laptop (12 MHz, 20 Meg) . 3249.

Tripp Lite ... 2 years

6201 Isobar 8 (8 outlets, 12 ft. cord) . 69.

6019 LS 600 Line Stabilizer 85.

6018 LC 1200 Line Conditioner 159.

Video 7 ... 7 years

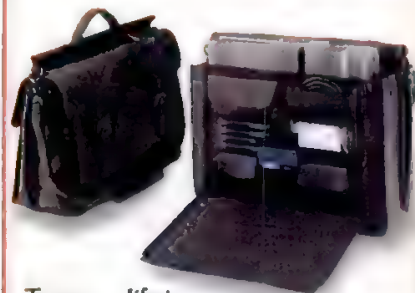
5883 1024i VGA (includes 512k) 289.

4931 VRAM VGA 512k 449.

DRIVES

DTC ... 1 year

6248 AT Floppy/Hard Drive Controller . 129.



Targus ... lifetime

Premier Leather Carrying Case—Establishes a new standard of quality for business related luggage. This dual purpose case combines a luxurious, feature rich, leather briefcase together with a functional laptop carrying case \$199.

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IOmega ... 1 year

- 5116 Bernoulli II Single 44 Meg Internal \$995.
- 5117 Bernoulli II Dual 44 Meg External 1969.
- 5113 44 Meg Cartridge Tripak (5 1/4") . . . 249.
- 2499 PC2 Card (controller required) . . . 169.

Mountain Computer ... 1 year

- 2917 40-60 Meg Internal Tape Drive . . . 379.
- 5502 83-152M Ext. Tape Drive 759.
- 5500 83-152M Int. Tape Drive 629.
- 6153 DC2120 Cartridge (5 pack) 135.
- 5190 DC2000 Pre-formatted Cartridges ea. 35.

Pacific Rim ... 1 year

- 5010 1.2 Meg External (for PS/2's) 215.
- 6602 1.44 External (for PC/XT/AT) 239.

Plus Development ... 2 years

- 3105 Hardcard 20 Meg (49 ms) 529.
- 3106 Hardcard 40 Meg (28 ms) 599.
- 6424 Hardcard II 80 Meg (19 ms) 699.

Seagate ... 1 year

FREE PCTV® Hard Drive Installation
Tape with purchase of 20, 30 or 40 Meg
Seagate drive for the IBM PC (not for
AT). Beta or VHS.

- 2285 20 Meg Internal Hard Drive ST225
(w/controller and cables, 65 ms) . . . 275.
- 2286 30 Meg Internal Hard Drive ST238
(w/controller and cables, 65 ms) . . . 289.



Practical Peripherals ... 5 years
2400SA MNP—Fully supports error-free MNP
Level 5 data transmission, giving you more
confidence in your communications. Also
supports Hayes compatible 2400 bps
standard operation. \$209.

- 4554 40 Meg Int. HD ST251-1 (28 ms) . . 359.
 - 2287 40 Meg Int. HD for PC ST251-1
(w/controller and cables, 28 ms) . . . 419.
 - 4624 80 Meg Int. HD ST4096 (28 ms) . . . 619.
- TEAC ... 1 year**
- 4950 PC, XT 360k Drive (5 1/4") 79.
 - 4951 720k Drive (specify XT or AT, 3 1/2") . 79.
 - 4670 1.44 Meg Drive for XT (3 1/2") 99.
 - 4326 1.44 Meg Drive for AT (includes Bastech
software utilities, 3 1/2" copy prot.) . . 119.

MISCELLANEOUS

Checkfree

- 6360 CheckFree Xpress 25.

CompuServe

- 1676 CompuServe Information Service . . 24.

Cables ... lifetime

- 1019 Smartmodem-to-AT cable (10 feet) \$15.
- 5511 Right Angle Printer cable (6 feet) . . . 15.
- 1050 Parallel Printer cable (15 feet) 19.

DISKS

All disks have a lifetime warranty.

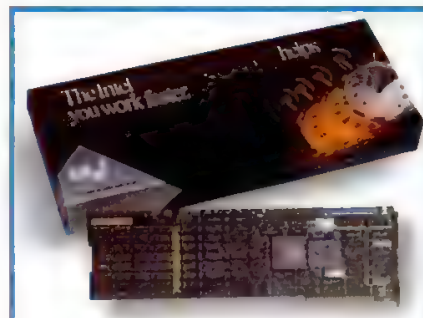
5 1/4" DS/DD Disks (360k)

- 3291 Sony (10 disks per box) 12.
- 2789 Maxell MD2-D (10 disks per box) . . . 13.



XTREE ... NCP

☐ **XTreePro Gold 1.3**—A treasure of advanced disk
management features—Directory Tree Display,
Application Menus, Archive Management,
Autoview & Enhanced View. Single keystroke
commands for all operations. \$75.



Intel ... 5 years

Inboard 386/PC—Brings advanced computing
power to your PC/XT system. Includes
16Mhz 80386 processor and 1Mb RAM.
Flexible 32-bit memory expansion options
are also available \$579.

5 1/4" DS/HD Disks (1.2 Meg)

- 3292 Sony (10 disks per box) 19.
- 2790 Maxell MD2-HD (10 disks per box) . . 19.

3 1/2" DS/DD Diskettes (720k)

- 3297 Sony (10 disks per box) 14.
- 2792 Maxell (10 disks per box) 15.

3 1/2" DS/HD Diskettes (1.44 Meg)

- 3298 Sony (10 disks per box) 29.
- 2793 Maxell (10 disks per box) 29.

MEMORY

- 3248 256k DRAMs (120 nanosecond) . . . call
- 4366 1 Meg x 9 SIMMs (100 nanosecond) call
- 5510 1 Meg x 9 SIMMs (80 nanosecond) call
- 5746 1 Meg Chips (80 nanosecond) call

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- No surcharge added for credit card orders.
- Your card is not charged until we ship.
- If we must ship a partial order, we never charge
freight on the shipment(s) that complete the order (in
the U.S.).
- No sales tax.
- All U.S. shipments insured; no additional charge.
- APO/FPO orders shipped 1st Class Mail.
- International orders U.S. \$250 minimum.
- Upon receipt and approval, personal and company
checks now clear the same day for immediate
shipment of your order.
- COD max. \$1000. Cash, cashier's check, or money
order.
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1:00 AM, or Saturday 9:00 AM to 5:30 PM. You can
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through Friday 9:00 AM to 5:30 PM.



WordPerfect Corp. ... NCP
☐ **WordPerfect 5.1**—Mix both text and graphics
with this "high-end" word processor/
publisher. Multiple new features including
"hot links" to 1-2-3, Excel, and PlanPerfect
along with networking—all built in . \$265.

SHIPPING

Note: Accounts on net terms pay actual shipping.

Continental US:

- For heavy hardware items such as printers, monitors,
Bernoulli Boxes, etc. pay actual charges. Call for UPS
2nd-Day & Next-Day-Air.
- For all other items, add \$3 per order to cover UPS
Shipping. For such items, we automatically use UPS
2nd-Day-Air at no extra charge if you are more than 2
days from us by UPS ground.

Hawaii:

- For monitors, printers, Bernoulli Boxes, computers,
hard drives, and power backups, actual UPS Blue
charge will be added. For all other items, add \$3 per
order.

Alaska and outside Continental US:

- Call 603/446-3383 for information.

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PC Cultivation.

**Silicon salad days.
(Or, how we mind our Peas & Cukes.)**

Way up north in the fertile crescent of Marlow, NH (pop. 562), we know how to dig down deep.

Which is pretty difficult (even for our celebrated 20 mole team) since the bedrock's just inches below the surface and the growing season's shorter than the day is long. But, with the winds of change blowing non-stop through the micro fields, you can't just scatter your seed any which way. You have to put down roots! We ought to know—we were the first company to sell peripherals and software exclusively for IBM personal computers. So when customers call us for product specs, prices, or

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A window-based system you can grow with.

Up here in Marlow, our imagination isn't the only thing that's fertile. In fact, it's small potatoes compared to our PC Connection Mint Garden which comes complete with soil and seeds for growing a luscious crop of Spearmint, Peppermint and Lemon Balm right on your favorite

window. Put a fresh sprig in your favorite beverage and we're sure it will add a delightful *je ne sais quoi* (which means that we have no idea what it will add—but it'll taste good). It's free to everyone who places an order of \$500 or more between now and June 30.



Grow your own in a PC Connection Mint Garden.
Offer not available outside the Continental U.S. or
to accounts on net terms. One per customer.

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PRICE WATERHOUSE REPORT LOW-END ACCOUNTING

To make matters worse, although this step can be password protected, that password is the same one that users must use to make master-file changes or additions. Consequently, if you want to give your users the ability to add vendors or customers, then there is no stopping them from making one-sided journal entries.

This potentially dangerous flaw aside, *DacEasy* easily handles on-the-fly master-

voices and then specify the customers that each invoice will apply to. Further customization allows you to enter customer-specific messages. Enter an order for a customer, and that customer's cash balance, credit limit, and recommendations for special treatment are displayed. This

F1 Help F2 Options F5 Lookup F6 Delete F8 Add F9 Edit F10 Process

***** ACCOUNTS RECEIVABLE TRANSACTION ENTRY *****

Transaction: 00007
Transaction Information Terms Information
Customer Code: 884540 Account: 1000000000

Account: 1000000000
Account Information
Account Name: Account Type: General Detail
Account Level: General Account:
Account Group: Asset Liability Capital Revenue Expense Other-Cr Other-Dr

Transaction Information Balance Information
Consolidation: Current: 0.00
Reconcile: No Yes

Totals: 10.00 0.00

file inquiries. To search individual master-file records while entering transactions, simply press F5. If that particular record does not exist or if it needs modification, press F8 and make the addition or change. Once complete, you are right back where you started. Moreover, *DacEasy* lets you determine which keys to sort when performing the lookup.

The Cash module consolidates all your cash transactions including checks, withdrawals, and deposits. By executing all cash disbursements and receipts, this module helps give you a contemporaneous record of your cash balances. The reconciliation feature allows you to enter bank adjustments and is integrated with the General Ledger module.

The Billing module presents a multitude of features, including unlimited ship-to addresses per customer, automatic quantity discounts, tracking of services or products, and automatic generation of back orders and subsequent invoices. When you complete an invoice, the F7 key prints the invoice—useful in a point-of-sale environment.

The recurring generation of invoices will allow you to set up boilerplate in-

DacEasy Accounting's extensive master-file inquiry and update feature are exemplified by the Accounts Receivable transaction entry screen. While entering transactions, the user can inquire about or add General Ledger account numbers.

feature is also available in the Accounts Payable and Purchasing modules.

While printing statements, you can create customized messages based on the age of the invoices. Statement codes will help determine which statements are printed. As in the Accounts Payable and Inventory modules, *DacEasy* generates statistical and forecasting reports. The statistical reports list the number of sales, returns, costs, and profits generated by each customer. The forecasting reports will take this information one step further and attempt, by four different techniques, to forecast next year's results.

The Accounts Payable module is tightly integrated with the Purchasing and Inventory modules; purchase orders are quickly turned into vouchers and inventory is automatically updated. If Purchasing isn't used, vouchers can be entered directly into the Accounts Payable module. Ac-

counts Payable will handle multiple checking accounts and print 1099s. Unfortunately, each voucher must be selected individually for payment and no pre-check-printing report is available.

The Inventory module is well integrated, updating the General Ledger module for inventory sales, receipts, and even physical inventory adjustments. Including such features as assembly, disassembly, and maintenance of two alternate vendor codes per item, *DacEasy* supports the average, standard, and last-purchase-price methods of costing. One costing method must be defined for all inventory items and not for a particular item.

The feature-rich General Ledger module allows both automatic reversing and recurring transactions. A recurring transaction can be set up by a flat amount or by percentage and track each transaction by both frequency and duration. *DacEasy* will perform unlimited consolidations of multiple companies. Entering budgets is smooth and effortless: monthly amounts may be entered, and there is an option to keep a running balance while you are entering monthly budget balances. When highlighting a particular period budget, pressing F3 will prompt *DacEasy* to duplicate the figure for all remaining periods.

Because it uses an alphanumeric account number that can contain up to ten characters, the account structure is potentially confusing. Departmental accounting is also possible, although cumbersome, as you must manually add each departmental account to the chart of accounts.

To maintain control over transactions that have an effect on prior periods, you can specify a particular period as active, disallow transactions to a prior period, or keep all prior periods open so that transac-

DacEasy Accounting

Suitability To Task

	0	1	2	3	4	5
Ease of Use					✓	
Functionality				✓		
Accounting Controls			✓			
User Interface					✓	
Value						✓
Enterprise Management				✓		

Ted Standish has a bear of a job.

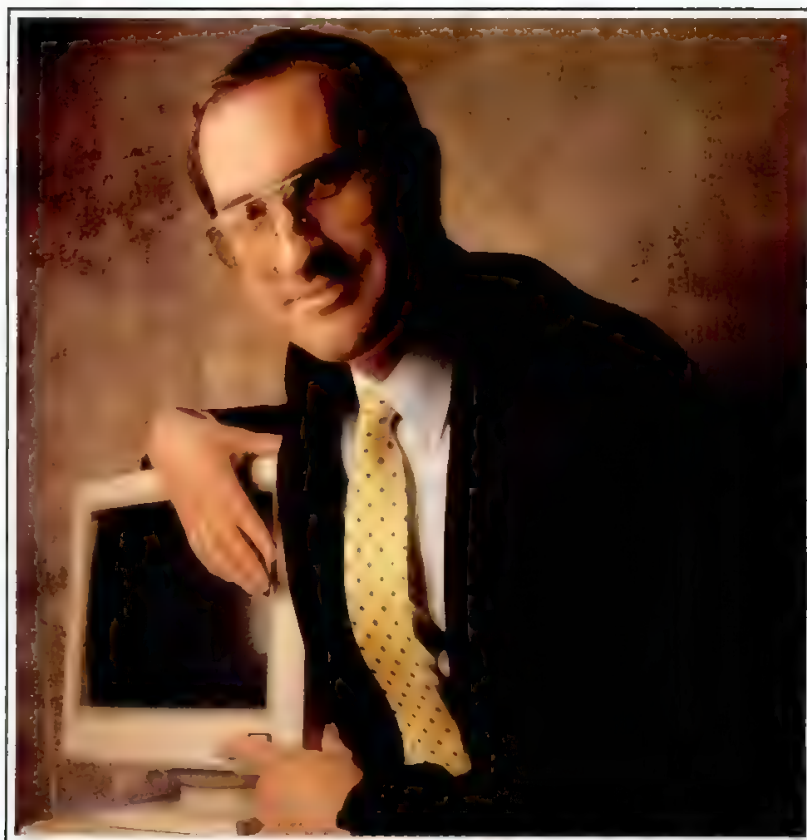
As Director of Information Resources for the North Atlantic Shaving Group of The Gillette Company, he has the task of simplifying and standardizing the business systems of the Company's European and North American divisions.

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Ted Standish, Director of Information Resources, North Atlantic Shaving Group of The Gillette Company

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FACT FILE

DacEasy Accounting, Version 4.03

DacEasy Inc., 17950 Preston Rd., #800, Dallas, Texas 75252; (800) 877-8088, (214) 248-0205.

List Price: \$149.95;

Payroll, \$99.95.

Requires: 640K RAM, hard disk, DOS 2.1 or later.

In Short: Version 4.03 is greatly enhanced with a friendly interface and a truckload of new features. It's the least-expensive package tested, and with a low-price multiuser version on the way, DacEasy could stake out an inexpensive growth path to those buyers looking to expand to a LAN.

CIRCLE 308 ON READER SERVICE CARD



tions can be posted regardless of the period. Future period transactions may be entered but will not be posted until that period is current. Owners of earlier DacEasy versions will be glad to hear that Version 4.0 will retain detail history until the year-end close.

One important note: DacEasy 4.0 was originally shipped with enough bugs to cause early users considerable difficulties. Most of the problems were corrected by Version 4.03. The rest may be corrected by the time this issue hits the newsstands. Also promised for the near future is a low-cost multiuser version.

DacEasy's custom and standard report writer and standard reports make for strong General Ledger reporting. Using these facilities will allow you to produce any report your business might need, including detailed turnover analysis, financial ratios, and detailed general ledger and custom financial statements. For versatility and ease of use, DacEasy is hard to pass up.

Peachtree Complete III

by Raymond A. August, Brian D. Callow, and David Peters

If you could find a definition for Peachtree in the dictionary, it might be the phrase "value for your money." At \$199, Peachtree Complete III from Peachtree Systems offers a comprehensive group of fully integrated modules. For an additional \$99, you can also acquire the company's versatile data query system, Peachtree Data Query (PDQ).

Peachtree caters to the small or mid-

PRICE WATERHOUSE REPORT LOW-END ACCOUNTING

sized business but is capable of functions expected in much higher priced packages. In fact, with a little elbow grease and a strong reliance on accounting expertise, you can close the gap between this package and one that costs hundreds—or even thousands—of dollars more.

The Accounting and DOS primer contains a good review of basic accounting requirements and the DOS commands needed to install the system. You need only install the modules your business requires. Multiple companies can be set up in separate directories to optimize organization and performance.

Peachtree's new menuing system is very helpful. Should you grow tired of the menu screens, however, they can be turned off. For the advanced user, a handy command-level alternative allows direct access to the function or screen desired.

When initializing the General Ledger, you have the choice of a five- or six-digit account code. The last two digits can be used for departments or divisions. In addition, you can use a predefined chart of accounts and then modify it to your specific needs. Superb query functions initiate lookups by account or description. The

query screens, like many of the reports, may take some getting used to. They are presented in a single columnar format that lists the debits as positives and the credits as negatives.

Transactions are posted immediately upon entry, unlike in a batch system.

Peachtree Complete III

Suitability To Task

	0	1	2	3	4	5	6	7	8	9
Ease of Use										
Functionality										
Accounting Controls										
User Interface										
Value										
Enterprise Management										

When you need to adjust an entry, you delete and then reenter it; or simply make an adjusting entry. Although an edit key is printed and can be toggled on or off, letting transactions could potentially create data control problems.

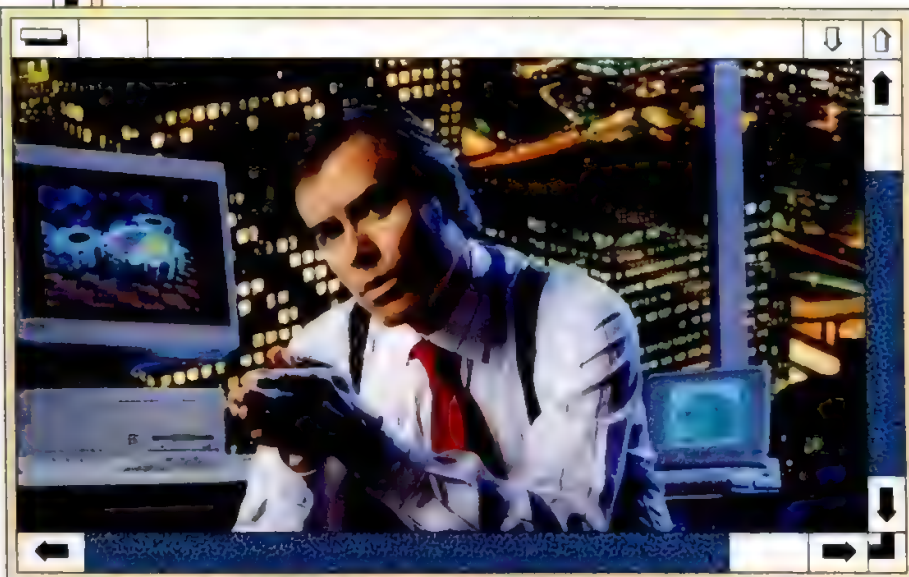
APR03 5.00 12/15/89		Query Customer Accounts WAVE'S SURFBOARD MANUFACT		COMPANY ID: 10 GENERATION 8: 11	
Customer ID: DURAND Dorothy Durand 900 Forest Drive Apt. 5 Atlanta, GA 30303					
Telephone #:	404/555-1212	LAST	DATE	AMOUNT	
Customer Class:	C	Debit	10/31/89	577.59	
Account Type:	B	Credit	10/23/89	-45.00	
Service Chg Code:	3	Payment	01/01/90	0.00	
Terms Code:	2 NET 30	Service Charge	10/31/89	18.09	
Sales Tax Code:	001	YTD		AMOUNT	
Credit Limit:	2000.00	Debit		2456.52	
Balance Forward:	2429.61	Credit		-45.00	
Ship Address:		Payment		0.00	
Billing Notices:	E	Service Charge		18.09	
Discount Percent:	0.00	Pending Invoices:		0.00	
		Adjusted Balance:		2429.61	

The Customer Inquiry screen in Peachtree Complete II presents a strong overview of a customer's account status, without forcing the user to review transaction details.

Users of Peachtree Complete II will be glad to know that they can now post general ledger transactions to a prior period. But it is important to note that you can't change the posting period in other modules without first going into the Options menu.

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Peachtree System's package uses a two-level password scheme. The first level, the controller password, allows the user complete access to the system. The second level, the operator password, restricts ac-

cess to the options screen only.

Financial statement formats are set through codes selected while entering your

chart of accounts. Report-printing parameters using current, historic, and budget data are flexible. Unfortunately, this configuration limits you to only one balance sheet and income statement format.

HOW BIG IS YOUR BUSINESS? A Guide to High-End Accounting

by Lee Thé

Before you buy a budget accounting package, make sure you're not getting less than you need. The next tier, including midrange products for up to \$1,100 more, may offer vital features that low-cost packages lack. Many of these can serve as upgrade products to our low-end review group. As with their cheaper brethren, midrange accounting products range from the newly bred to the nearly dead. But with bonuses such as multiuser capability, it's tempting to spend some extra money.

Those serious about upgrade paths should take a look at our high-end accounting software review in the September 26, 1989 issue of *PC Magazine*. You'll find *AccPac Plus*, *Data Pro Accounting Series*, *Great Plains Accounting Series*, *Macola*, *Platinum Series*, *RealWorld Accounting System*, *SBT Database Accounting Library*, and *Solomon III*.

Upgrade options obviously matter to those with rapidly growing businesses. They need a product that will either grow with them or that they can grow into. But even those with stable businesses can benefit from surveying the midrange. In many cases the savings in time and trouble will offset a higher purchase price. The products reviewed here don't always restrict you to their current incarnations.

■ Computer Associates' *Bedford Integrated Accounting* belongs to a product line created wholly by acquisitions. *AccPac Bedford* comes from a different source than *AccPac BPI*, the next product up the line. *AccPac Plus*, the next above that, derives from yet another source. Not surprisingly, none of these products shares much in common regarding user interface or file structure. Presumably CA will evolve these product lines more closely over the years. This year we can expect a *Bedford-BPI* data conversion utility release.

AccPac BPI 3.0 represents a significant upgrade from prior versions, mainly in ease of use, reporting, and data verification. (It had not been released at time of this writing.) System modules consisting of General Ledger, Accounts Payable, Accounts Receivable, Inventory, Payroll, and a one- to eight-user *LanPak*, will cost \$395 each—a lot less than the \$750 or so typical for high-end products, though quite a step up from *Bedford*.

■ Cougar Mountain's *Act 1* was developed from the \$995 multiuser *Act 2* system. This makes for a seamless upgrade to *Act 2*'s multiuser, multimodule accounting—complete with true file and record locking—at a fire sale price.

■ *DacEasy 4.03* is a single-user version of the concurrently developed *DacEasy Network Accounting System*, making for a nearly effortless upgrade. And the \$499.95 price adds more than just multiuser capability: *DacEasy Payroll 4.0* and a personnel management module are included in the bundle as well.

DacEasy's Network Accounting module wasn't ready as of this review but, according to *DacEasy*, it's on the way. If *DacEasy* has done its homework, this module could serve as a viable alternative to far more expensive multiuser accounting systems. One caveat: *DacEasy* has been known to release products too early. The firm works hard to correct bugs, but early buyers risk becoming involuntary beta sites.

■ *Peachtree Complete III* currently has no upgrade path other than the PDQ query/report module. A NetBIOS-compatible network module was under development at time of this writing. Check with *Peachtree* for an update on this upgrade.

■ TLB's *ProfitWISE 1.1* is a scaled-down version of the well-known *Solomon III* high-end package, which costs

\$795 per module. This is the steepest upgrade path cost of any product we reviewed. However, if you plan to buy *Solomon III* at some point, *ProfitWISE* makes for a bargain-basement route to that purchase. TLB's product line represents something of a paradox: a strong, feature-rich accounting package built on the aging *MDBS III* database, which needs more user maintenance than do most of the competing products.

Upgrade paths aside, several midrange accounting products offer interesting alternatives to the low-cost packages reviewed here.

■ *Stage 1 Small Business Accounting*, like TLB's *ProfitWISE*, is a scaled-down version of a high-end multiuser package, *Data Pro Advanced Business Accounting*, which we generally praised in the September 26, 1989 issue of *PC Magazine*. *Stage 1* costs \$100 for the System Manager, plus \$295 per module: Accounts Receivable with Invoicing, Accounts Payable with Checkwriting, Inventory Management with Sales Analysis, General Ledger with Financial Report Writer, and Payroll with Checkwriting are all available.

You get a lot for the steeper price, starting with a higher degree of integration between modules. Some examples: you never enter a transaction twice. When you void a check, the necessary reversing entries ripple across all modules automatically.

Cash requirement reports, vendor aging reports, a sales code summary, a detailed sales journal, and fully automated 1099s are only some of the useful reports produced by this package.

Stage 1's database itself is more useful than dozens of checklist items on a features table. However, it does impose arbitrary limitations: 500 customers, 1,000 inventory items, 250 general ledger accounts, 100 vendors, 100 employees.

Control reports can be printed throughout the entire process of data entry. Oddly, *Peachtree* will not force you to print a posting report when performing a sub-ledger post to the general ledger. Such a re-

port serves as a helpful audit trail.

With Accounts Payable you can process recurring invoices and pay outstand-

ing invoices automatically or manually. When paying manually, you can select specific invoices or all invoices by vendor. AP, unlike AR, requires that payment terms are input each time a voucher is add-

As in *ProfitWISE*, the upgrade cost of *Stage 1* is offset by a flat conversion path: same data files, same interface. Note that with both products you must go to the higher-end product to get additional modules, such as the custom report writer.

■ Great American Software's *One-Write Plus Accounting System*, Version 2.05, offers maximum ease of use for those less interested in the fast track than the smooth track. The interface emulates that of the popular *Safeguard* pegboard system. This cash- and/or accrual-based package costs only \$299

for a tightly integrated bundle comprising Accounts Receivable with Invoicing, Accounts Payable, and General Ledger with Checks and Receipts. The Supertrack feature is a database system that integrates with *OneWrite Plus* to let you capture and track nonaccounting data at the same time that you capture and track accounting data.

Options include Payroll for \$149, the *DataLink* multiformat data export utility for \$59, and a new \$100 utility, *Bridge*, scheduled for release by the time this review is published. This menu-driven product will integrate *One-Write Plus* with *Lotus 1-2-3* in order to automatically produce spreadsheets and graphs for budgeting and forecasting.

One-Write Plus's features include Speed Search, which lets users look up any vendor, account, or customer with only a few keystrokes, as well as the ability to print lists, reports, and mailing labels from customer/vendor "cards."

Compared with *DacEasy 4.0*, *One-Write Plus* has less depth of functional-

ity but is easier to use. Compared with *Bedford*, it offers at least as much ease of use, coupled with far more headroom within the product.

■ *Manzanita BusinessWorks 7.0* shares an emphasis on ease of use with *One-Write Plus*, but in a higher price class: \$795 for Accounts Receivable, Accounts Payable, and General Ledger. Add \$295 for Payroll. A four-user network version costs \$995. Multiuser upgrades cost \$150 per module. And an Inventory module is in the works.

Features include a mailing list manager, an export/import utility with *dBASE*, *1-2-3*, and others, multilevel password access, multicompany support, built-in ZIP code list, audit log of recent changes to key data files, multi-printer support, up to 24 months of historical data, e-mail for the LAN version, and no arbitrary limits on database capacities.

Those who love *Bedford* and *One-Write*'s ease of use but need more accounting power will love *BusinessWorks*—as long as they don't need Inventory. ■

AccPac BPI, Version 3.0, Computer Associates International Inc., 1240 McKay Dr., San Jose, CA 95131; (800) 531-5236 outside Calif., (408) 432-1727. List Price: GL, AR, AP, Payroll, Inventory, and LanPak (an eight-user LAN package), \$395 each.

CIRCLE 407 ON READER SERVICE CARD

Act 2, Cougar Mountain Software, 2609 Kootenai, Box 6886, Boise, ID 83707; (800) 344-2540 outside Idaho, (800) 727-9912 inside Idaho, (208) 344-2540. List Price: \$999.50; Job Cost: single-user \$199.50; multiuser, \$599.50; Act 4 (Xenix version), \$1,995.

CIRCLE 408 ON READER SERVICE CARD

Stage 1 Small Business Accounting, Data Pro Accounting Software Inc., 5439 Beaumont Center Blvd., #1050, Tampa, FL 33634; (800) 237-6377

CONTINUES

Most companies make their accounting packages easier to use by limiting functionality, especially in terms of management information, but *Manzanita BusinessWorks* avoids this pitfall. For example, the customer ID screen automatically includes the customer's high year-to-date and month-to-date balances, the last check paid, aging information, credit information, and a user-defined comments field.

BikeWorks International
Customer Credit Inquiry

Posting Date: Dec. 27, 1989

Customer Information

Customer ID: IBS

Customer name: Inter. Bicycle Sales

Telephone number: (212) 567-7900

Contact name: Robert Yarnis

High balance: 14931.26

Y-T-D sales: 18026.82

R-T-D sales: 3095.56

Last payment date: 06/27/89

Amount: 1945.00

Check no.: 2029

Comments

Do you want to edit the comments? Yes ☐ No ☒ Page

[Esc: Cancel] [F1: Help] [F3: Prev] [F4: Next]

Credit Information

Current: 0.00

1 to 30: 0.00

31 to 60: 0.00

61 to 90: 0.00

Over 90: 2870.82

Unpaid invoices: 2870.82

Open credits: 0.00

Finance chgs: 2.00

Net balance due: 2872.82

Deposits: 0.00

Credit limit: 10000.00

Available: 7127.18

Percent used: 29%

ed. Invoices cannot be edited once they have been input, although you can delete them any time before they have been paid. The system also allows you to hold payments for individual invoices or specified vendors.

Accounts Receivable processes regular and recurring invoices and maintains both open-item and balance-forward customer accounts. For each account, you have the

choice of both bill-to and ship-to addresses. Some of the AR reports and listings most important to good cash management include aged receivables, past-due accounts, and customer statements.

Invoicing is integrated with Accounts Receivable and produces standard-format invoices as well as back-order and inventory activity reports. Invoicing allows immediate invoice printing, making *Peachtree* desirable for a point-of-sale operation. However, if the sales price of an inventory item is changed, *Peachtree* does not provide an audit trail of that change. This could cause problems if your sales clerks are giving preferential treatment, without your approval, to some customers. Mailing labels can also be generated through the main utilities.

In our tests, some invoice detail lines were switched from the sequence in which they were input. This resulted in shipping charges showing up as the first item on the invoice, which may not be desirable in some cases.

Inventory Control handles fundamental stock-control requirements. *Peachtree* offers the LIFO and FIFO costing methods in addition to standard, weighted average,

HOW BIG IS YOUR BUSINESS?

CONTINUED

outside Fla., (813) 885-9459. **List Price:** Customer Value Pack, including GL, AP, AR, Inventory, and Payroll, \$1,475 (\$295 each if sold separately, plus one mandatory \$100 System Administrator per system).

CIRCLE 400 ON READER SERVICE CARD

One-Write Plus Accounting System, Version 2.05; Great American Software, 615 Amherst St., Nashua, NH 03063; (603) 889-5400. **List Price:** with GL, AR and AP, \$299.

CIRCLE 410 ON READER SERVICE CARD

BusinessWorks, Version 7.0, Manzanita Software Systems, 2130 Professional Dr., #230, Roseville, CA 95661-3751; (800) 531-3552 outside Calif., (800) 447-5700 inside Calif.,

(916) 781-3880. **List Price:** with GL, AR, and AP, \$795; four-user version, \$995; Payroll, \$295.

CIRCLE 411 ON READER SERVICE CARD

Solomon III, TLB Inc., 1218 Commerce Pkwy., P.O. Box 414, Findlay, OH 45839; (419) 424-0422. **List Price:** System Manager: single-user, \$95; two- to five-user, \$795 (System Manager and GL required for all systems). GL, AR, AP, Payroll, Fixed Assets, and Inventory, \$795 each; Purchasing, Order Entry, Report and Graph Designer, Database Reporter, and External Systems Interface, \$695 each; Sales Analysis, \$295; Job Cost, \$995; Address and Mail List, \$195.

CIRCLE 412 ON READER SERVICE CARD

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just got

Application for Employment

Prospective employees will receive consideration without discrimination because of race, creed, color, sex, national origin, handicap or veteran status.



CORNERSTONE
Corp.

PERSONAL	Last Name
	Street Address
	City, State, Zip
	Have you ever ap
	Position Desired?
	Apart from above ☐ Yes ☐ No
	Are you legally el
	Other special trait
How did you learn	

Stafford Kissell & Paulsworth

Dear Jonathan,

"How are you gonna keep 'em down on the farm after they've seen Paris?"

Enclosed is an application for employment with a solid, little company called Cornerstone. They've been looking for a "heavy" with international accounting experience to run the show. The pay and the perks are great. And, oh yeah, their office is in Paris...you know, France.

This could be the opportunity you're looking for. It's a young, aggressive group. And, if all works out, I'll have a friend in Paris. *N'est pas?*

Any interest?



FACT FILE

Peachtree Complete III

Peachtree Systems,
4355 Shackleford Rd.,
Dept. PCM, Norcross,
Georgia 30093; (800)
247-3224, (404) 564-
5800.

List Price: \$199; with
Peachtree Data Query, \$298; PDQ alone,
\$99.00; Custom Report Writer, \$100.00.

Requires: 512K RAM hard disk, DOS 3.0 or
later

In Short: This package boasts the largest
number of modules of the products tested in this
review and is a good choice for a company with a
wide range of requirements. Complete III has
gone a long way to improve the weaknesses of its
predecessor, Complete II.

CIRCLE 399 ON READER SERVICE CARD



PRICE WATERHOUSE REPORT LOW-END ACCOUNTING

GL accounts, customers, suppliers, and inventory parts can be added on the fly. This saves you the considerable trouble of having to exit whatever module you're working in, go to GL, add something, and then return to your original module.

The *Peachtree Data Query* system (PDQ), a strong tool for writing custom reports and performing ad hoc enquiries, is well integrated with the base accounting modules. PDQ also comes with a number of predefined reports that can be run in each accounting module.

Peachtree's on-line help feature is quite good, although not available in all functions. Job Costing, Fixed Assets, Payroll, and Purchase Ordering modules are also included with the base package. The Purchase Order module interfaces with both the Inventory and Accounts Payable modules and assists in the effective management of your Inventory.

Peachtree Complete III includes a multitude of features for a low-priced system and deserves your consideration—provided you need those features and you're at the level necessary to learn and use them.

ProfitWISE

by Raymond A. August,
Barbara Jicha, David Reed,
and Thomas White

TLB's *ProfitWISE* is a good bet for a small business in need of accounting software with plenty of functionality and growth potential. *ProfitWISE* was written by the same company that wrote *Solomon III*, a highly regarded high-end accounting package. Because of its exceptional functionality, *ProfitWISE* requires users to have more accounting experience than its counterparts, but the payoff is high.

The \$229 *ProfitWISE* (\$349 with the Report and Graphics Designer), looks and feels like *Solomon III* and includes many of the same features as its big brother. As your accounting needs expand, you can easily convert to the *Solomon III* system—both products use the same database structure. Moreover, *ProfitWISE* uses the same data-entry screens as *Solomon III*. And while *ProfitWISE* limits your accounting database to 5MB, this ceiling should be sufficient for most companies handling amounts of \$5 million or less.

affordable.

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5 7/8"

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CIRCLE 235 ON READER SERVICE CARD

ProfitWISE

Suitability To Task

	0	1	2	3	4	5
Ease of Use					✓	
Functionality				✓		
Accounting Controls					✓	
User Interface				✓		
Value				✓		
Enterprise Management					✓	

ProfitWISE guides you through installation and setup. The user reference manual is comprehensive and concise. If the manual is not handy, the F1 key gives you access to on-line, context-sensitive help. *ProfitWISE* presents its processing, data entry, and report options in an attractive menu overlay structure. The Inquiry pop-up window, available for most of the data entry screens, is activated by the F3 key. Inquiry offers a convenient way to access associated master-file records. In addition, some data file fields support a "quick maintenance" facility that allows the addition of master-file records while entering transaction data.

ProfitWISE's General Ledger module allows you to create batches of recurring journal entries for transactions that occur on a regular basis. This includes transactions whose dollar amounts remain the same each period, as well as transactions whose dollar amounts vary. You can also specify the number and frequency of the recurring entries.

In addition to a six-digit prime account, you can also have ten six-digit subaccounts. These subaccounts allow for the tracking of departments, cost, or profit centers.

The General Ledger report writer allows you to define, by row and column, up to ten custom General Ledger reports. By entering question marks, you can summarize or enumerate data based on each digit of the account or subaccount. For example, to report or query all accounts that begin with a 1, simply enter 1?????. This useful masking feature is consistent throughout all modules of *ProfitWISE*.

To further add to *ProfitWISE's* level of sophistication, you can maintain up to

PRICEWATERHOUSE REPORT LOW-END ACCOUNTING

three budgets per account within *ProfitWISE* and produce budgets versus actual reports.

The Accounts Payable module has a number of features that assist you in managing your cash outflow. When you enter vouchers, *ProfitWISE* will automatically calculate and display the discount and the voucher due date based on the terms code prescribed for that vendor. When you are ready to pay vendors, you must go to the payment selection screen to select the unpaid vouchers. Unfortunately, *ProfitWISE* requires that you manually select vouchers for payment.

The vendor trial balance lists the current activity for each vendor, including voucher amounts, payments, and adjustments. The information is also available on-line from the vendor maintenance screen. The aged accounts payable report gives you the option to age payables according to days past due or days until due. Oddly, *ProfitWISE* has no provision for voiding checks, and although it captures 1099 information, it does not have any way to print that information.

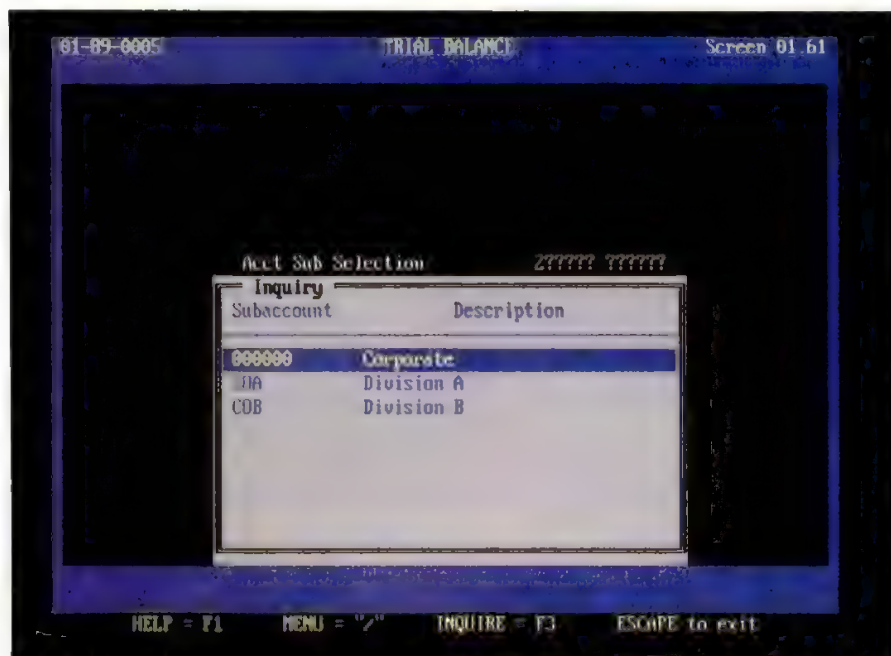
The Accounts Receivable module boasts some elegant features, such as multiple ship-to addresses, three levels of sales

The Accounts Payable module has a number of features that assist you in managing cash outflow.

sales by unique customer classifications. For example, you could separately track sales information for all wholesale and retail customers.

The Invoice module allows you to invoice for either inventory items or services. Item quantities from inventory invoices are updated appropriately in the Inventory module and, if sufficient quantities of items are unavailable, back orders are created.

The Inventory module automatically updates the general ledger and calculates cost of goods sold. The inventory master files allow you to define up to three warehouse locations, register lot or serial numbers, and maintain two suppliers and part numbers per item. The inventory trial bal-



tax, multiple bank accounts, and the ability to group customers in different statement cycles. Each customer can be set up as balance-forward or open-item.

The ability to track by two different customer classes permits the tracking of

ProfitWISE's strong masking features allow users to specify each digit of each account number for several different types of reports. Shown is a request for a trial balance for all account numbers beginning with a 2.

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PURCHASE ORDER (New)

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- P.O. numbers pre-assigned or assigned at printing
- Tracks multiple vendors for each stock number
- **PLUS** many more features

CHECK RECONCILIATION (New)

- Bank/Checkbook or Checkbook/Bank reconciliation
- Accommodates recurring transactions
- Master password and operator password security
- Easy conversion from manual or other auto system
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COMPLETE USER'S MANUAL (New)

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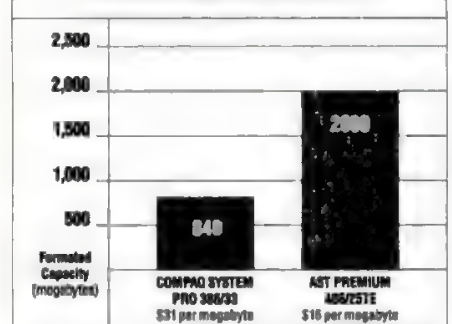
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one manufacturer.

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Oddly, *ProfitWISE* has no provision for voiding checks, and although it captures 1099 information, it does not have any way to print that information.

PRICE WATERHOUSE REPORT LOW-END ACCOUNTING

ance maintains an excellent detail listing of all transactions affecting each inventory item. *ProfitWISE* supports the average, standard, and user-specified cost methods.

In addition to superior integrated Fixed Asset, Address, and Payroll modules, *ProfitWISE* also offers an elaborate Job Cost module. Job Cost is integrated with the Accounts Payable, Payroll, and General Ledger modules and allows you to track labor and materials by jobs, phases, and cost type.

ProfitWISE offers you an affordable, feature-packed, fully integrated accounting software package capable of addressing today's needs. And with the ability to upgrade to *Solomon III* easily, it may well address tomorrow's needs, too.



FACT FILE

ProfitWISE,
Version 1.1

TLB Inc., 1218
Commerce Pkwy.,
Findlay, OH 45840;
(800) 777-0521, (419)
424-0422.

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Requires: 640K RAM, hard disk, DOS 3.1 or
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In Short: Long on controls, functionality, and
reporting, *ProfitWISE* is the most sophisticated of
the low-end crowd. As your business grows, a
potential upgrade to *Solomon III* could be a big
plus, though a costly one.



CIRCLE 400 ON READER SERVICE CARD



EDITOR'S CHOICE

Close but no Cigar

This year's crop of low-cost accounting packages has much to recommend it, but each product suffers from a significant handicap that prevents any one of them from winning the Editor's Choice title. The Editor's Choice That Wasn't is *DacEasy Accounting*. *DacEasy* has managed to gain a few lengths on the competition, with its wholly rewritten Version 4.03. It delivers neither the most power nor the greatest ease of use, but rather the strongest combination of the two. The spiffy new user interface goes about as far as you can go in character mode.

DacEasy currently suffers from two problems: first, our reviewers and early paying customers had to wrestle with significant bugs, not all of which were fixed in Version 4.03. Second, even as of Version 4.03, not all the advertised features had been implemented. Expect these difficulties to be resolved some time this spring.

Each of the other products in this review demonstrates one or more areas of strength, but has at least one detracting factor as well. *Peachtree Complete III* and TLB's *ProfitWISE* tied for the runner-up slot. Both appeal more to the knowledgeable

user than to the ease-of-use seeker.

Peachtree's new menu system adds sparkle to an interface that dates back to the early 1980s, but it still needs a more extensive facelift. And, like Cougar Mountain's *Act I*, it still uses line editing rather than full-screen editing.

Peachtree provides the greatest number of features and functionality within modules, including many standard reports and excellent query handling. Plan on getting the bundle with the optional report writer, which raises the package's cost by about \$50. *Peachtree* needs functional updating in some areas, such as its limited General Ledger reporting, and in integration of the inventory module with the rest of the system—also a problem with *ProfitWISE*. With both products, don't assume that the way one module works or interacts with the overall system is true for all other modules within the package.

ProfitWISE does offer many reports, full-screen editing, and pull-down menus, but less-knowledgeable users will find it unwieldy. We didn't like some of the arbitrary limitations imposed to distinguish it from *Solomon III*, such as a maximum of ten subaccounts, a 5MB database,

and an underlying database that can be too easily corrupted.

Cougar Mountain's *Act I* offers less breadth but more depth than *Peachtree* and *ProfitWISE*. It has the most affordable multiuser upgrade to both LAN and Unix environments. And Cougar Mountain is the only company in this group that modifies its software in order to suit the customer's needs.

Computer Associates's *Bedford Integrated Accounting* offers greater ease of use than any other package reviewed here, but take a look at *DacEasy* 4.03 before you buy. It has far more functionality than *Bedford*, without a comparable rise in complexity.

But you say you want *Peachtree's* power combined with *Bedford's* ease of use? Unfortunately it doesn't exist yet; and the truth is that moving up in price may solve enough problems to persuade you to abandon the low-end market. Still need a double-entry accounting system for under \$250? Pick up one of these packages today, and by the time you're ready to replace it, a new generation of GUI-based packages will be here with just what you're waiting for. That is, if you're willing to wait.

Word's out.

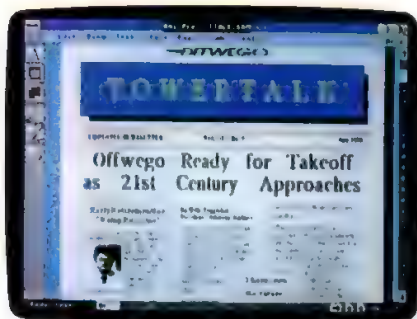
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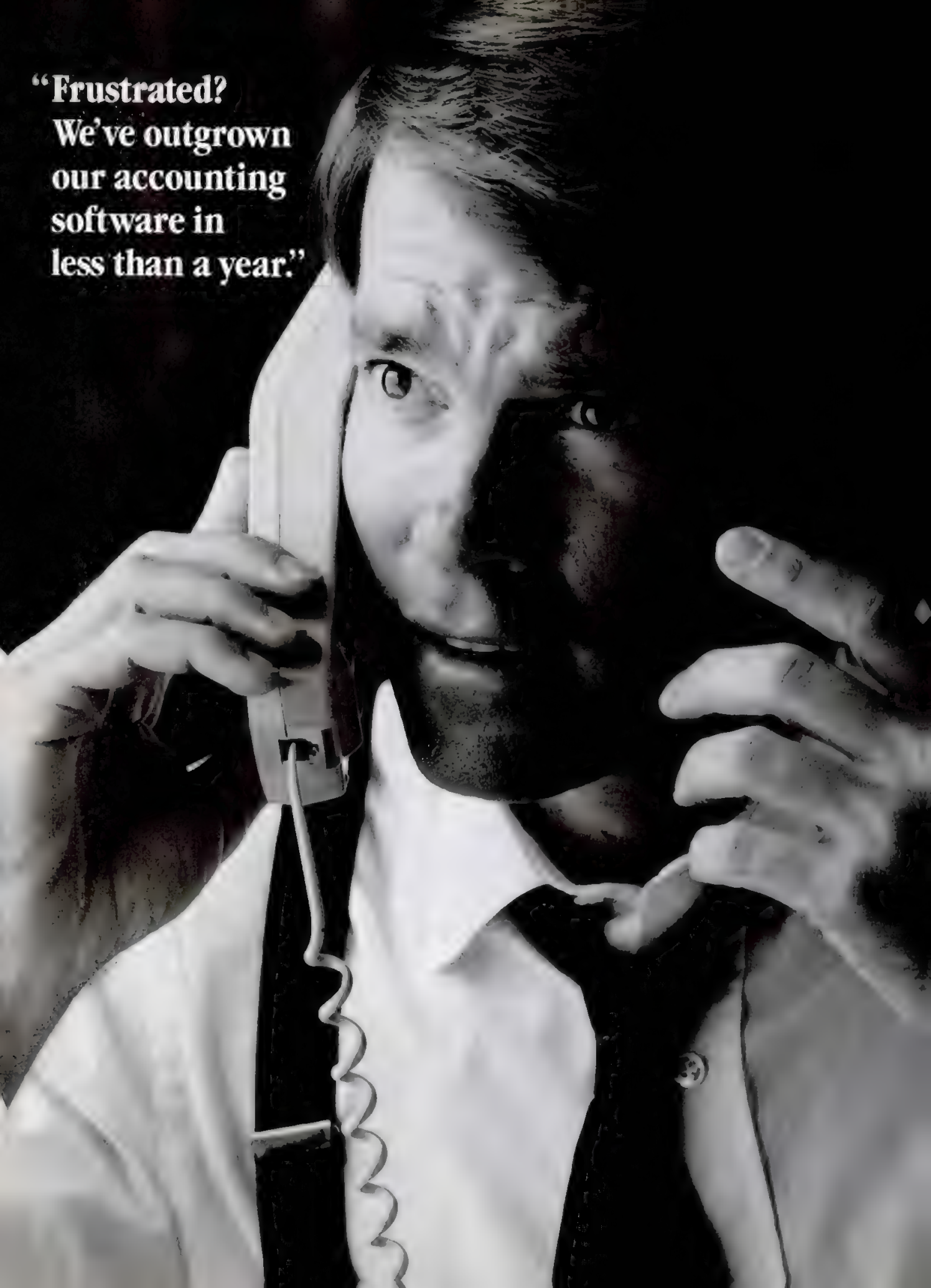
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The Best Computer \$43,000 Can Buy

The dual-processor Compaq Systempro
is today's splurge and tomorrow's
insurance policy.

by Robert W. Kane and Matt Ross

When Compaq introduced its multiprocessor, multiple-hard-disk Systempro, priced at \$15,999 to \$42,356, the company threw down the gauntlet for future personal computer development. Compaq's new system shares a joint evolution: the individual components spring from Compaq expertise in personal computing, but the philosophy behind this powerful multihost system can be traced to the mainframe and minicomputer industries.



Compaq is not unique in this approach. Computer developers as a group recognize the performance barrier now hindering new systems. In the past, system engineers used brute force to obtain higher performance—to get data into RAM faster, process it faster, and write it out to disk faster—with processing speed as the major area of improvement. In the past four years processing speeds have doubled and tripled, from 4.77 MHz to 8, 12, 16, and 20 MHz, and with the introduction of the 80386 processor, up to 25 and 33 MHz. It's no secret that these performance increases were realized by forcing instructions through the CPU at faster and faster speeds.

As the MHz rating increases, the task of building a computer has proved to be more difficult. Greater electromagnetic emissions, timing problems, and the physical limitations of the silicon itself have compelled systems engineers to be more creative in raising the overall performance of new systems. It will be considerably more difficult, if not impossible, to double and triple the processor speeds of today's fastest PCs.

THE DESKTOP MAINFRAME

The answer to the PC performance dilemma is found by looking at mainframes and minis. Typically designed to serve many users simultaneously, these computers usually contain multiple processors and disk drives to work on several tasks concurrently. Multiple processors allow more users to be served at the same time with minimal degradation in performance, or the increased processing power can complete a series of tasks sooner.

Multiple drives allow data to be written across several platters simultaneously, thus reducing the latency (wait time) of the next sector or track to be presented to the drive head for reading or writing. This trend of dividing work, primarily among multiple CPUs, is moving quickly into the PC environment. In addition to the Systempro, with its dual processor support, Zenith's Z1000 Unix system and the Mitac Series 5000 support multiple processors, and the list continues to grow.

What makes the Systempro stand apart from these other machines is that Compaq did not stop with adding an additional 386 or 486 CPU (only the dual-386 configuration is currently available). The Systempro also boasts multiple disk drives linked through its Intelligent Drive Array controller, which can govern up to eight Conner

hard disks for 1.6 gigabytes (1,600MB) of internal storage, plus the new Extended Industry Standard Architecture (EISA) expansion-bus architecture to utilize the full 32-bit and bus-mastering potential of the 80386 and 80486 processors.

Again drawing from the mainstream of computer development, Compaq's drive array technology mirrors technology used throughout the mainframe and minicomputer industries. By reading and writing

The Systempro is
meant to anchor your
Unix, Novell, or
LAN Manager network.
To achieve this
goal, Compaq created
a beast unlike
any other Compaq
computer.

information simultaneously to more than one hard disk, the Systempro effectively lessens data read and write times for 18-millisecond hard disks that mechanically are no faster than any other 18-ms. hard disk.

Likewise, the wider bandwidth of the 32-bit EISA bus alleviates the I/O bottleneck faced by the current generation of 386 and 486 PCs based on ISA (Industry Standard Architecture) buses. While EISA operates at the same 8-MHz speed as ISA buses, the 33MB-per-second burst transfer rate EISA bus permits moving data more than 15 times as fast as a 16-bit ISA PC.

With the incorporation of Intel's 82355 Bus Master Interface Controller (BMIC), Compaq's Systempro is one of the first personal computers to incorporate bus mastering—the capacity of allowing an expansion peripheral to take control of the system bus without involving the processor, as when a disk controller transmits data to system memory independently. Bus mastering prevents additional CPU

clock cycles because the processor is not involved in the activity operating on the expansion bus. The processor is left free to continue performing instructions.

A GLORIFIED PC?

In successful designs, function determines form, and the Systempro is no exception. Ask the designers of the Systempro about its function and they will describe the unit as a high-performance file server or a powerful multiuser host, with the computing power and capabilities of minicomputers costing hundreds of thousands of dollars. Under DOS, the Systempro demonstrates no real speed gains. As a standalone PC capable of dual 33-MHz 80486 support, up to 256MB of system RAM, and a maximum internal storage of 1.6 gigabytes, the Systempro is nothing more than an overgrown 486 that besides eating its Wheaties guzzled down a pound or so of anabolic steroids.

Plain and simple, the Compaq Systempro is no faster than any other standalone PC because its designers did not intend it to be. Users of CAD, numerically intensive applications, and high-end graphics can choose among Compaq's Deskpro 386/33 and 486 machines as well as the multitude of other fast PCs.

The Systempro is meant to anchor your Unix, Novell, or LAN Manager network. To achieve this goal, Compaq created a beast unlike any other Compaq computer. To support the seven EISA slots and the four dedicated Flex/MP memory and processor slots, as well as the 11 drive bays, Compaq had to abandon its standard desktop design in favor of its first tower configuration. But a closer look quickly dispels the notion that the Systempro is just a Deskpro turned on its side.

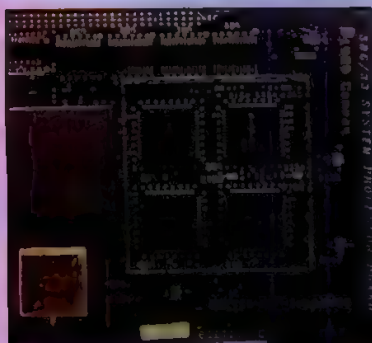
SYSTEM BASICS

The Systempro measures 23.75 by 7.5 by 22 inches. Its stylized case sports an aesthetically sloped front panel, which contains the three drive bays intended for removable media. The design of this unit is carefully planned and well executed; while the sloped front contributes to the unit's overall appearance, good looks are not the reason behind this design. Slanting the drive bays upward facilitates the insertion and removal of tapes and floppy disks from the floor-standing tower.

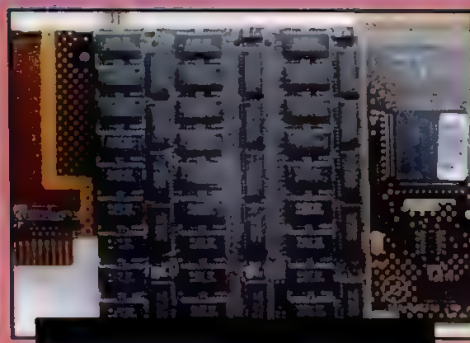
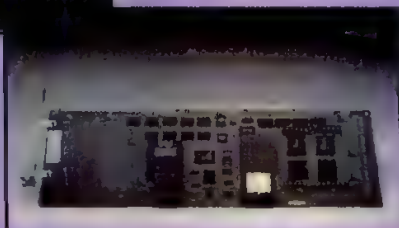
The system sent to PC Labs came fully equipped with a 1.2MB 5.25-inch floppy disk drive, a second 1.44MB 3.5-inch high-density floppy drive, and a



INSIDE THE COMPAQ SYSTEMPRO



The 33-MHz processor board can hold both an 80387 and a Watek 3167 simultaneously. In addition to the 80386 processor, the board holds an 82385 cache controller, which oversees 64K of 25-nanosecond cache RAM and is normally enclosed in a shield to reduce emissions.

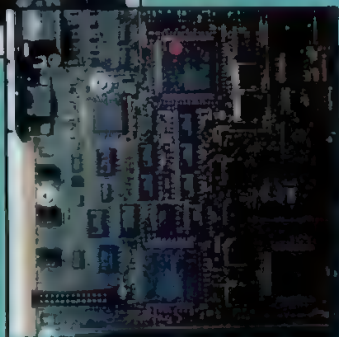
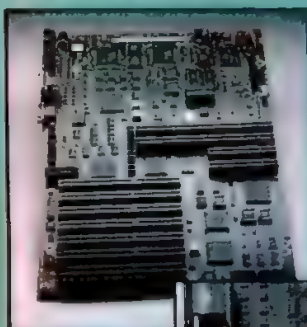


The standard memory board in the Systempro comes with 4MB RAM. It accepts up to 64MB RAM using 4-megabit chip technology. Pictured here is the optional 8MB memory module, which uses 1-megabit chips.

Next to the module is the VGA pass-through connector. Located on this board because of its proximity to the EISA bus, it has no interaction with the memory on the same card.

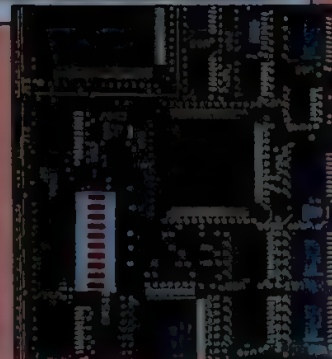
The motherboard of the Compaq Systempro contains seven EISA slots as well as four Flex/MP slots. The lower two Flex/MP slots are used for memory expansion only and accept up to 160MB of system memory. The upper two slots hold the system's two processor boards—although the second processor slot can be used for a third memory board, providing RAM expansion to a total of 256MB.

Also found on the motherboard is the built-in VGA featuring Compaq's graphics accelerator. With 256K of video RAM and hardware BitBltting, Compaq's VGA is one of the fastest video systems available today. The VGA pass-through connector to the memory card is visible at the bottom of the photo.



The Intelligent Drive Array is the heart of the Compaq Systempro's I/O performance; it represents a major advance in storage technology. The Intel 82355 Bus Master Interface Controller (BMIC) allows the drive array to transfer data to system RAM unsupervised by the CPU. A bank of ten LEDs indicates which drive in the array is currently being accessed. Unfortunately, this bank is buried inside the case instead of residing on the front panel where it could provide valuable information about the operations of the drive array.

The drive array controller is also equipped with an LED and a speaker to indicate when a drive mechanism has failed. A momentary-contact switch mutes the speaker—a nice touch that reflects the Systempro designers' attention to detail.



COMPUTERS

COMPAQ SYSTEMPRO



SUMMARY OF FEATURES: COMPAQ SYSTEMPRO

	Compaq Systempro
Price of tested configuration	\$42,356
Microprocessor	Two 33-MHz 80386s
Motherboard manufacturer	Compaq
Chip set manufacturer	Compaq, Intel
System RAM arrangement	Page mode
Wait states	0
Coprocessor	80387-33, Weitek 3167-33

PROCESSOR RAM CACHE

Cache controller	Two Intel 82385-33s
Installed RAM	64K per processor
Maximum installable RAM	64K per processor
Rated speed	25 ns.

MOTHERBOARD MEMORY

Installed RAM	N/A
Maximum installable RAM	N/A

ADD-IN MEMORY BOARD

Installed RAM	12MB
Maximum installable RAM	256MB with 1 processor, 192MB with 2 processors

RAM packaging (and rated speed)

Chip size	1Mb
-----------	-----

BIOS

BIOS version and date	Compaq Rev. 386E (December 1989)
-----------------------	----------------------------------

Password in ROM	■
System shadowing/Can be disabled	■ / □
Video shadowing/Can be disabled	■ / □

HARD DISK

Manufacturer	Conner
Disk capacity	840MB
Interface	Intelligent Drive Array
Average access time	18 ms.
Controller location	Card
Controller manufacturer	Compaq
Hard disk options	120MB, 210MB, 320MB, 650MB (Intelligent Drive Arrays)

INTERNAL FLOPPY DISK DRIVES

Capacity	1.44MB, 1.2MB
Size	3.5-, 5.25-inch
Manufacturer	Citizen, Canon

TAPE DRIVE

Manufacturer	Wang-tek
Capacity	150/250MB
Tape medium	DC-600
Software	Sytos

■—Yes □—No
N/A—Not available: the product does not have this feature.

CONTINUES

150/250MB DC-600-type tape drive. At the time of this review, the Systempro was available in dual-386 configuration only, not in the dual-486 arrangement for which it is also equipped.

Remove the cover and you'll immediately be impressed by the quality of design, the construction, and the attention to detail. The Systempro boasts a surprisingly light but strong aluminum frame with riveted joints, and one sidewall is a solid panel, giving the system added strength.

The Systempro's interior has a spacious, organized design cooled by two fans, which are positioned to create the optimal convection cooling. One fan sits at the top of the case; the other is in the front near the bottom. This allows the system to draw in the cooler air near the floor and circulate it up through the unit, venting the warmer air out the top.

The 300-watt power supply is encased in aluminum to contain unwanted electromagnetic emissions. Although the power supply runs along the entire top of the case, its aluminum design prevents the unit from being top-heavy. The system is not unnecessarily cluttered with ribbon cable and power leads—one more indication of thoughtful design.

Sitting at the bottom of the unit are the eight interior drive bays. The tested system came equipped with four 210MB Conner hard disks, which, combined with Compaq's 32-bit Intelligent Drive Array controller, act as a single 840MB logical unit. By placing the drive bays at the bottom of the case, the Systempro's engineers created a low center of gravity, adding to the stability of the tower.

SYNCHRONIZED DRIVES

The drive array controller resides in the first slot from the bottom, with the next six slots supporting any ISA or EISA expansion card. These first seven slots are governed by the Intel and Compaq EISA chip sets and are all capable of supporting standard 8/16-bit ISA expansion boards as well as the new generation of 32-bit EISA boards. Because there is no dedicated 8-bit ISA slot, the one incompatibility the bus will have involves those older 8-bit cards with skirts that don't fit in the 16-bit extension on the ISA bus, such as the original IBM CGA adapter and some scanner cards.

The Intelligent Drive Array (IDA) is the first EISA peripheral from Compaq.



SUMMARY OF FEATURES: COMPAQ SYSTEMPRO

	Compaq Systempro
EXPANSION	
Bus speed	8 MHz
Expansion slots	Seven 32-bit EISA, four proprietary
Available slots	Four EISA, one proprietary
Drive bays	10 half-height, 1 one-third-height

VIDEO

Display circuitry location	Motherboard
Interface	16-bit VGA
Chip set manufacturer	Compaq

KEYBOARD

Number of keys	101
Number of function keys	12
Keyboard cable length	66 inches

SOFTWARE AVAILABLE

OS/2	1.1, 1.2 (\$340)
Disk caching software	■
Expanded memory manager	■

PHYSICAL FEATURES

Power supply size	300 watts
Switchable power supply	■
Number of device connectors	11
Keyboard lock	None
Case lock	Back
Power-on switch	Front
Reset button	None

MISCELLANEOUS

Distribution channel	Dealer
Warranty	1 year
Service	Return to dealer
FCC certification class	B

■—Yes □—No

ENDS

While the IDA comes standard in the Systempro, it is also offered as an option in the Compaq Deskpro 486/25 EISA system—and should work in any EISA-based system.

The IDA can control up to eight hard disks, treating them as one logical drive. To accomplish this, Compaq has synchronized the drives so that the same sector is presented to all the drive heads at the same time. The IDA continually speeds up or slows down individual drives until they are all indexed with each other. This permits data to be written across however many drives are in the array rather than being written to successive sectors and tracks on just one disk drive. Compaq has taken this concept, known as data striping, directly from the mainframe world. As more drives are added to the array, the write performance is increased.

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Compatibility	PC,PS/2, Macintosh	PC,PS/2, Macintosh	PC,PS/2 N/A
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# Drives on-line	0-7	0-2	0-2
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MOVING?

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from the IDA, something a little different happens. As read requests are made of the drive array, the controller compiles a command list. With its own 16-MHz 80186 processor, 128K of ROM, and 256K of RAM, the drive array controller has the ability to prioritize the read requests and determine the most efficient way to retrieve the data from the drive array. Once the list is completed, the controller commands the drives to perform the reads and places the data into a 128K 30-nanosecond SRAM transfer buffer to permit bursting of the data across the EISA bus. This transfer buffer is separate from the memory that the 80186 processor uses to compile its command list.

The IDA also contains the Intel 82355 Bus Mastering Interface Controller (BMIC), which permits the IDA to trans-

HOW WE TESTED THE COMPAQ SYSTEMPRO

The Compaq Systempro's groundbreaking design and intended environment present several new challenges in testing. To provide meaningful comparative results, we tested the Systempro using SCO Unix System V/386, Release 3.2.0. This operating system runs the 386 processor in its full 32-bit addressing mode and was the only system software available at the time of this review that supported the dual-processor test configuration. We enhanced the operating system with a prerelease of the multi-processor extensions (MPX, Release 0.0) that permit the workload to be split between the two processors. SCO developed these extensions in a joint effort with Corollary Systems.

We configured the Unix system kernel with the standard defaults for an automatic installation, then tested the Systempro both with one processor and with two processors running, with workloads simulating one interactive user and four interactive users. For comparison, we have included results for a Compaq Deskpro 386/33 Model 320, again with one interactive user and with four.

The testing suite we used to measure the performance of these systems is the Monash Benchmark Suite (MUSBUS), Version 5.2. Developed at the Monash University Department of Computer Science in Clayton, Australia, MUSBUS allows the tester to make multiuser performance measurements while simulating the work of interactive users. MUSBUS can also measure various aspects of hardware speed or system efficiency. MUSBUS is freely distributed and is available on systems such as **unnet**.

Because Unix varies from one implementation to another and the operating-

fer data across the bus without any supervision from the CPU. This is the standard controller for bus mastering in an EISA system and was found on the NE3200 EISA Ethernet interface controller also included with our review unit.

PROTECTION AGAINST THE CRASH

Realizing that the Systempro would be used in a multiuser environment and that data within the system is split among as many as eight drive mechanisms, Compaq's engineers gave the IDA several different methods to guard against data loss caused by mechanical failure of a drive. *Drive mirroring* is a redundant write scheme that uses half of the drive capacity in the system. When information is written to one drive in a two-drive system, the IDA automatically writes the same infor-

system kernel can also be customized, MUSBUS is promoted as a diagnostic and benchmark test tool rather than an absolute benchmark standard. The results we present here involve only a portion of the MUSBUS performance tests, which exercise various arithmetic, processor, memory, and disk functions.

For the arithmetic tests, the overhead involved in processing the looping mechanism has been left in the results to reduce their granularity. For each test involving one user, we used one long iteration, while for each test involving four users, we used six long iterations. Thus we repeated each test a consistent number of times, insuring a high degree of accuracy in the results.

We found one anomaly in the system's use of the 80387-33 floating-point processor. Our system, which included only one 80387, did not use the floating-point unit with two processor boards installed and the single processor kernel running. With the MPX extensions loaded and the 80387 located on processor board 1, the floating-point time was cut approximately in half, indicating that the Unix scheduler was sending half of the floating-point instructions to the board with the 80387 and the other half of the instructions to the board without one. But with the 80387 loaded on processor board 2, floating-point times indicated that all instructions were being executed by the 80387.

These results were repeatable on our test machine, but Compaq could not duplicate them. This might be due to the early release of the MPX software (0.0), but it demonstrates that system administrators and operators for this new breed of multiprocessor file server must constantly monitor and configure their machines in line with their resources and applications. The days of the "if it ain't broke, don't fix it" system administrator are over. In addition, more-substantial testing of the Systempro is warranted as the OS/2 LAN Manager and Novell NetWare 386 multiprocessor kernels become available.



PERFORMANCE TESTS: COMPAQ SYSTEMPRO

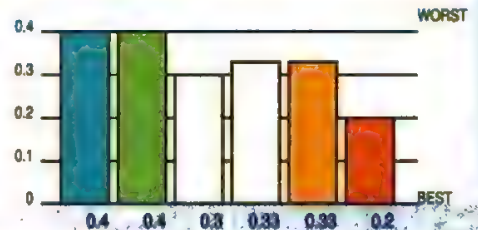
The Compaq Systempro 386/33 demonstrates the high performance of a prize-winning racehorse, although this pace-setter requires the special care and attention of all thoroughbreds. Customization is needed to optimize the dual-processor system to its full potential.

MUSBUS UNIX TESTS

Arithmetic Operations — Int

Elapsed Time (seconds)

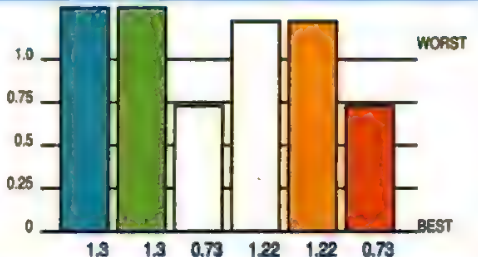
The Arithmetic Operations—Int test performs arithmetic operations using integer mathematics in an iterative loop consisting of 4-byte numbers. Our timing measures mathematical performance without an 80387.



Arithmetic Operations — Float

Elapsed Time (seconds)

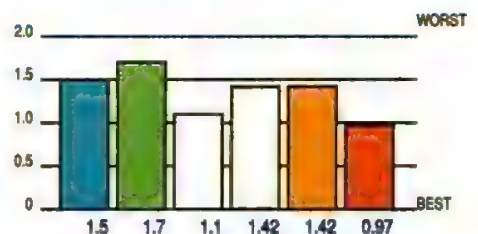
The Arithmetic Operations—Float test performs arithmetic operations using floating-point mathematics in an iterative loop consisting of 4-byte numbers. Our timing measures mathematical performance with an 80387.



System Call Overhead

Elapsed Time (seconds)

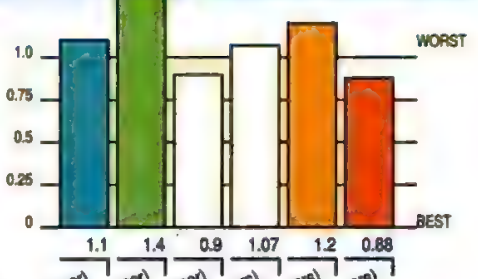
In the System Call Overhead test, the software makes loops of calls to the operating system, consisting of nondisk operations. Although not all the calls are common in every Unix program, they are similar to most Unix system calls in terms of system overhead.



Pipe Throughput

Elapsed Time (seconds)

In the Pipe Throughput test, a program is created that opens both ends of a Unix structure known as a pipe, which allows one process to send data to another. Data written out to the pipe is read back in by the same process, and the time to finish a given number of iterations is recorded.



* Compaq Deskpro 386/33 Model 320 (1 user)
Compaq Systempro Model 386-840 (1 processor, 1 user)
Compaq Systempro Model 386-840 (2 processors, 1 user)
* Compaq Deskpro 386/33 Model 320 (4 users)
Compaq Systempro Model 386-840 (1 processor, 4 users)
Compaq Systempro Model 386-840 (2 processors, 4 users)

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COMPUTERS

COMPAQ SYSTEMPRO

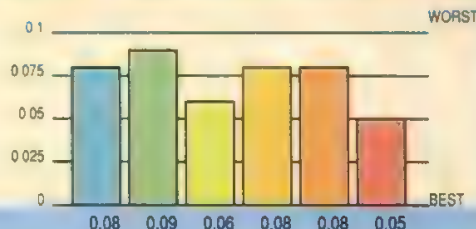


PERFORMANCE TESTS: COMPAQ SYSTEMPRO

Sequential Memory Array Access

Elapsed Time (seconds)

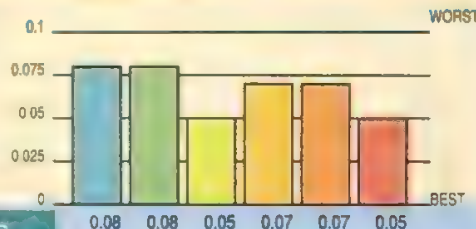
The Sequential Memory Array Access test makes 100,000 sequential memory accesses of a 512K array in memory. Sequential accesses are typical of many mathematical operations.



Random Memory Array Access

Elapsed Time (seconds)

The Random Memory Array Access test makes 100,000 random memory accesses of a 512K array in memory. Random accesses typify complex data-sorting operations.

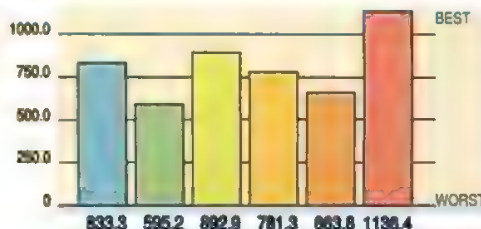


DISK THROUGHPUT TESTS

125-Block File Copy

Throughput (kilobytes per second)

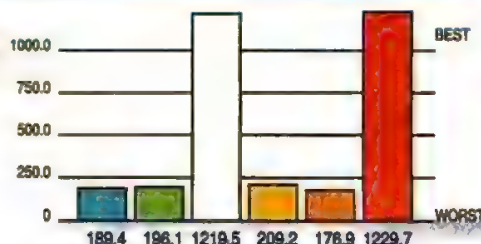
The 125-Block File Copy test measures the time it takes to copy a file containing 125 blocks (512 bytes each). This is representative of both disk read and disk write performance; the results include memory access overhead for a small file.



500-Block File Copy

Throughput (kilobytes per second)

The 500-Block File Copy test measures the time it takes to copy a file containing 500 blocks (512 bytes each). This is representative of both disk read and disk write performance; the results include memory access overhead for a large file.



• Compaq Deskpro 386/33 Model 320 (1 user)
Compaq Systempro Model 386-840 (1 processor, 1 user)
Compaq Systempro Model 386-840 (2 processors, 1 user)
• Compaq Deskpro 386/33 Model 320 (4 users)
Compaq Systempro Model 386-840 (1 processor, 4 users)
Compaq Systempro Model 386-840 (2 processors, 4 users)

* Reported for comparison.

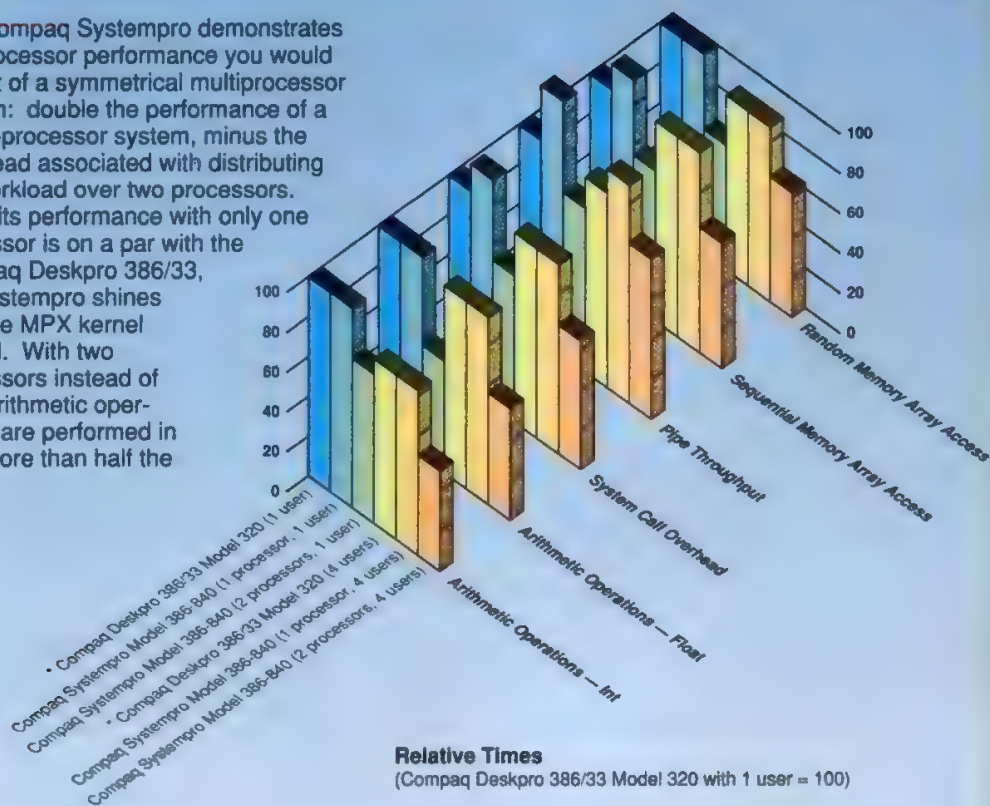
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MUSBUS UNIX TESTS: COMPOSITE VIEW

(Shorter bars represent better performance)

The Compaq Systempro demonstrates the processor performance you would expect of a symmetrical multiprocessor system: double the performance of a single-processor system, minus the overhead associated with distributing the workload over two processors. While its performance with only one processor is on a par with the Compaq Deskpro 386/33, the Systempro shines with the MPX kernel loaded. With two processors instead of one, arithmetic operations are performed in little more than half the time.



643.88

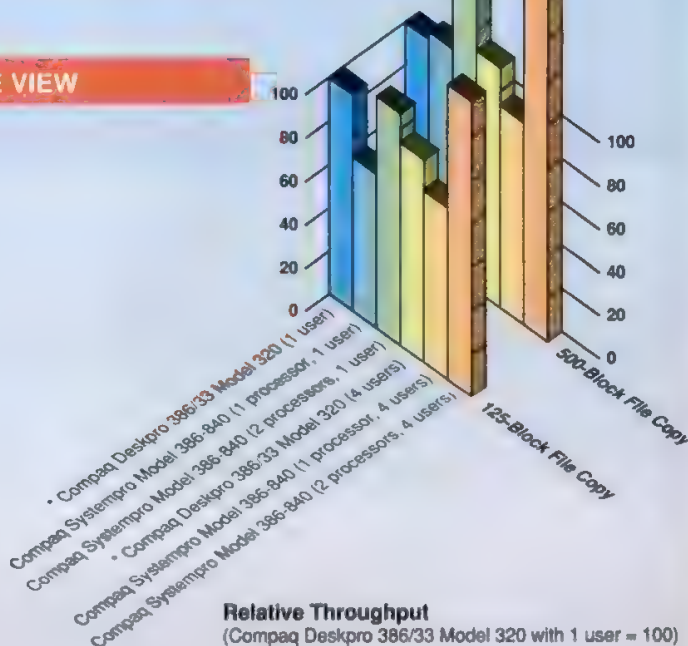
649.26



DISK THROUGHPUT TESTS: COMPOSITE VIEW

(Taller bars represent better performance)

With four simulated users on the system, the dual-processor Compaq Systempro's Intelligent Drive Array whips almost six times as much data through the drives as the Compaq Deskpro 33/386. The use of 32-bit data transfers, the system's ability to process multiple requests simultaneously, and the buffering performed by the two processors under Unix all contribute to the outstanding scores. These results lend credence to the idea of scalable performance: as more users are added, the innovative disk system is capable of meeting the demands.



* Reported for comparison.

ENDS

mation to the second drive, so that the two drives contain identical data.

The main drawback of drive mirroring is the amount of storage capacity it uses; half of the total drive capacity must be sacrificed. While it ensures a high degree of data reliability, data mirroring is impractical for those who need as much storage capacity as they can get.

Compaq's alternative to drive mirroring, *data guarding*, can be enabled in ei-

ther four- or eight-drive IDA systems (as opposed to drive mirroring, which can be enabled with two, four, six, or eight drives). Guarding requires only one quarter of the system's total disk capacity to protect the data in the drive array. When information is being "striped" across the array in a four-drive system, data is written to three of the drives. The controller then

takes the data from the three drives and performs exclusive ORs on the data to come up with a checksum value which is then striped to the fourth drive. The fourth drive behaves like a parity chip in system memory to maintain the integrity of the data.

In the event of a drive mechanism failure, once the faulty mechanism is replaced the system can reconstruct the data on the new drive by exclusive ORing of the data on the remaining drives, which returns the data that was lost on the failed drive. This function can be performed in the background without halting system operations. The only instance where data guarding won't work is when multiple drive mecha-

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Compaq's engineers
gave the Systempro's
Intelligent Drive
Array several methods
to guard against data
loss caused by
mechanical failure
of a drive.

nisms in the array fail simultaneously. But according to Compaq engineers, the odds are that this will happen once every 100 years.

If you are the paranoid type (and have lots of money), another option available to protect the data on the drives is to *duplex* the IDA. The Systempro can accept two of the \$2,499 IDA controllers and two sets of drive arrays. With controller duplexing enabled, write redundancy is performed across drive array systems. This way, whether a drive mechanism or the controller fails, the system can still function with all of the data intact.

Lest you think that Compaq hasn't thought of everything with regard to the IDA, the system also possesses the ability to inform the user or network administrator when a drive mechanism has failed. A piezoelectric speaker located on the IDA controller emits a high-pitched tone when such a failure occurs. A green LED pro-

truding from the back panel of the IDA controller card indicates which drive has failed, and a momentary-contact switch located next to the LED is used to mute the loud (and annoying) speaker.

A bank of ten LEDs is located internally on the drive array controller. The first eight show which drive mechanism is being accessed. The other two indicate when any read or write request is being made of the drive array. These LEDs mirror the disk-activity LED located on the top front panel of the system unit. Overall, the design and implementation of the IDA set the standard for multiple-drive systems of the future.

THE FLEX/MP CONCEPT

The remaining four slots, numbers 8, 9, 10, and 11 on the system board, comprise the Flex/MP host bus. The Flex/MP bus is dedicated for system RAM, processing, cache memory, and mathematical coprocessing. Flex/MP architecture is an implementation of the theory behind the Flex architecture found in the Compaq Deskpro computers, which run the CPU and system memory on a bus separate from the expansion bus. Flex/MP (flexible system architecture with multiprocessor support) adds support for a second CPU and provides the fastest possible execution of instructions between the CPUs and system memory while preserving the 8-MHz speed of the EISA bus.

The top slot must carry the primary CPU card, which contains 64K of 25-nanosecond cache memory, Intel's 82385 cache controller, and the 33-MHz 80386 processor. The system submitted to PC Labs featured a second CPU card in slot 10. Both 386 CPU cards accept the Weitek 3167-33 and Intel's 80387-33 math coprocessor, with dedicated slots for each. The tested unit had both the Weitek and the 80387 coprocessor installed on the primary CPU card.

Compaq has announced a 33-MHz 486 CPU card for the Systempro, scheduled to ship in the third quarter of 1990. In addition to the 80486's 8K internal cache, the card will have a 128K external cache.

Slot number 8 holds the system RAM board, with 4MB of 80-nanosecond DRAM standard. The evaluation unit contained 12MB of system RAM in all; the computer can hold a total of 64MB on this board alone via two 32MB memory modules using 4-megabit DRAM chips. This board also features a pass-through VGA connector for use with high-resolution vid-

eo adapters such as Compaq's Advanced Graphics 1024 Board.

Flex/MP memory slots 9 and 10 can hold a card that accepts several different combinations of memory daughtercard modules—up to three 32MB modules, for a maximum 96MB. (Since this card does not provide a pass-through VGA connector as found on the primary memory board, the third memory module can be added.) A single-processor Systempro holds up to 256MB; with two CPUs installed, the maximum system memory is 192MB.

The Flex/MP design is unique in its multiprocessor support. Compaq designed

The Flex/MP bus adds support for a second CPU and provides the fastest execution of instructions between CPUs and system RAM while preserving the 8-MHz EISA bus speed.

the processor boards so that they can be used interchangeably, regardless of the type of processors used. Two 33-MHz 386s, two 33-MHz 486s, or a combination of 386 and 486 processors may be used in the Systempro. This interchangeability can be important, depending upon which operating system you choose. The one hardware constraint is that both processors must operate at the same speed.

The only difference between the two processor boards, other than the obvious differences between the 386 and the 486, is that the 486 board has a 128K static RAM cache as opposed to the 64K cache on the 386 processor board. The larger cache complements the 128-bit-wide internal cache found on the 486 and helps speed processor functioning to zero wait states even on a 486 internal cache miss. Compaq would not say whether the 486 processor board would support a Weitek coprocessor.

THE SOFTWARE STORY

Taking advantage of all this power requires special modifications to existing software in order to split the load among multiple processors and multiple disks. Because the full 32-bit processing power of the 386/486 isn't used under MS-DOS, the drive array doesn't perform 32-bit bus-mastered transfers, and there is no way to access all 256MB of RAM the system can hold. The solution to this problem is to modify the software at the systems level. Leaving conventional applications untouched and making the system software responsible for distributing the tasks among the system resources creates a ready market for a multiprocessor system of this type.

As of this writing, no software is available that fully exploits the capabilities of the Systempro. However, Novell, Banyan, Microsoft, and SCO have all announced that they will support the Systempro with specially modified versions of their products. These companies are representative of the multiuser markets for which the Systempro is designed.

How will the software being designed for the Systempro take advantage of a dual-processor system? Both Banyan VINES and SCO Unix are designed to use the two processors in a symmetrical fashion. Since Unix and VINES are both task-oriented operating systems (VINES is derived from the Unix operating system), all system functions are broken down into tasks and passed through a scheduler. When either processor in a dual-processor setup is ready for a task, it requests work from the scheduler.

While one processor is busy working, the second processor can make a request of the scheduler and have a task passed to it as well. Regardless of which processor finishes its task first, the next task in the scheduler is ready to be acted on by either processor; thus, each processor is kept working all the time. This is known as *symmetrical processing*.

By contrast, Microsoft's *LAN Manager* for OS/2 processes data asymmetrically. Under *LAN Manager*, the first processor in the system is responsible for carrying out the functions of the operating system and its applications. The second processor is used to control the high-performance file system (HPFS) and is responsible for network file transport. (*NetWare 386* will support the Systempro in a fault-tolerant environment.)

Each processor is assigned to specific

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CIRCLE 521 ON READER SERVICE CARD

tasks and the amount of work each must do depends on the loading of those tasks, so these environments are considered asymmetrical. As a result, one processor is left with much less work to do than the other. This doesn't increase processing power but it does extend the capacities so that as users are added, there is no system degradation.

The only system software available in time for this review to test the multiprocessor capabilities of the Systempro was *SCO Unix with MPX* (multiprocessor extensions). With the backing of a system vendor like Compaq, all the major system software manufacturers have expressed interest in the Systempro in particular and multiprocessor systems in general, lending more credence to this type of CPU design for PCs.

The software for which you use the Systempro might dictate your choice of processors. In a truly symmetrical environment, such as Unix, it doesn't matter if the system has a 386 and a 486 processor. Since the 486 chip is capable of processing more information in a given amount of time than the 386, it will simply request more tasks from the scheduler, keeping both processors operating at 100 percent capacity. Under *OS/2 LAN Manager*, the first CPU has more to do running OS/2 and applications. With the combination of a 386 and a 486 processor in this environment, the 486 should be the primary CPU, as it must do most of the work.

THE PRO IN ACTION
When Compaq designed the Systempro, the company just didn't stop. The Systempro sports a new 16-bit video interface that's built into the motherboard. This redesigned VGA controller chip carries the lengthy name of Integrated Video Graphics System with Graphics Accelerator, and



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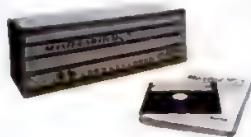
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THE PRO IN ACTION
When Compaq designed the Systempro, the company just didn't stop. The Systempro sports a new 16-bit video interface that's built into the motherboard. This redesigned VGA controller chip carries the lengthy name of Integrated Video Graphics System with Graphics Accelerator, and

Novell, Banyan,
Microsoft, and SCO
have all announced
that they will
support the Compaq
Systempro with
specially modified
versions of their
products.

it proves to be equally long on performance.

With the *Windows* driver for the graphics accelerator enabled, we found that the display controller on the Systempro runs 2 to 8 times as fast as a standard VGA adapter. The BitBLT (bit block transfer) Engine within the controller is largely responsible for this incredible improvement, providing for faster manipulation of video information. The new video controller chip is pin-compatible with the previous generation of Compaq video controllers, and it behaves

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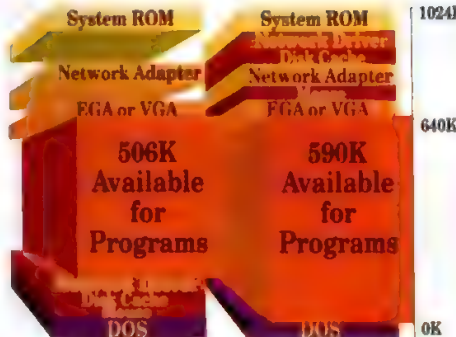
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Both give you expanded memory compatible with EMS 4.0 and EEMS. Both are also extended memory managers, compatible with XMS.

And both give you maximum control over your memory in the 640K-1024K area, guiding you through decisions on where to move TSRs and network drivers for maximum performance.

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mode code with a numerics efficiency that approaches 100%, without resorting to global optimization or assembly language. *These products are important because most programmers are still using real mode tools in their 386 systems, despite the advantages of the 386's 32 bit architecture.* The tools solve problems with the Intel real mode segmented architecture which hinders the performance of numerics coprocessors. They employ algorithms that cannot be easily implemented by general purpose compilers.

For example, if you compare programs that multiply matrices, you will discover that the huge model code produced by an excellent product, such as Microsoft FORTRAN, runs 2 to 4 times slower than the MatrixPak matrix multiply. MatrixPak employs a unique storage algorithm in conjunction with runtime binding to produce its results. The same technique is

employed by 87FFT, which also employs an "in core" solver that makes it possible to perform FFTs on arrays stored on disk.

387Basic is another MicroWay classic. PC Magazine's November, 1989 review of the current BASICs says,

"387BASIC is the product to use if you have a program which is numeric intensive...the programs ran faster than any of the other BASICs and generated more accurate results."

Naturally, we still sell our NDP Fortran, C, and Pascal 386 compilers and the coprocessors you need to make them perform. PC users have been relying on MicroWay for 8 years to solve their numerics problems. If you have a question about which coprocessor is best suited to your application, call or write for our brochure, "The State of PC Numerics in 1990" by Stephen S. Fried.

287 Tools

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like conventional VGA controllers when the *Windows* and *OS/2 Presentation Manager* graphics accelerator drivers are not enabled.

Enabling these drivers unleashes the incredible performance potential built into the graphics accelerator. The BitBLT Engine has three modes: moving video information rapidly from the 256K of video memory to main system memory; transferring information from different sections within the video memory; and performing color fills (shading in defined areas on-screen with certain colors).

All three BitBLT Engine functions are performed by firmware instructions within the video controller rather than tying up the CPU, the data bus, and system memory by executing these instructions via software. With these built-in facilities, the Systempro can perform certain graphical applications such as scrolling, pop-ups, and pull-down menus significantly faster than other 16-bit VGA interfaces.

Compaq also shadows the Systempro's

The new video circuitry from Compaq isn't intended solely for the Systempro: it extends to all future Compaq Deskpros and Deskpro 486s that build VGA graphics into the motherboard.

video BIOS in system RAM, and the entire VGA circuitry can be disabled via a motherboard jumper. If you choose to go to a higher-resolution video adapter, the Systempro provides VGA pass-through to ensure software compatibility. The pass-through is incorporated into the primary memory card that resides in slot 8 on the systemboard, and this connection is totally separate from the system memory. Compaq's engineers chose to incorporate the pass-through here with the understanding that the additional video adapter would sit

in the last EISA slot (slot 7), making the connection between the pass-through and the video board closer and easier.

The new video circuitry raises the question of whether this advancement is the natural outgrowth of such a well-designed machine, or rather an unnecessary extravagance in a file server that would do just fine with a \$150 monochrome system. The an-

swer is both. A multiuser host simply has no justification for high-end graphics capabilities. But the new video circuitry from Compaq is not intended solely for the Systempro: it extends to all future Compaq Deskpro and Deskpro 486 models that incorporate VGA graphics into the system board. For Compaq, the cost of including a top-notch video system in the Systempro is minimized, without compromising a major portion of the system.

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COMPUTERS COMPAQ SYSTEMPRO

TAKE OUT YOUR CHECKBOOK

Are the capabilities of the Compaq Systempro worth the high price of admission? It's true that not many people have the \$42,356 it would take to buy the system tested in PC Labs. But it is unlikely that

**The Systempro's
strongest selling
point is its scalable
performance, which
makes it immune to
untimely death from
rapid obsolescence.**

such a loaded system is what most customers will purchase straight out of the box. Instead, the more likely buyer will start with the \$15,999 base system with 4MB

RAM, 240MB of disk capacity (two 120MB drives with the drive array controller), and one 386 CPU board, perhaps adding some extra system memory.

The next step will involve increasing disk storage, as networks soak up disk capacity quickly. As needs grow and more users are added to a working Systempro-based network, upgrading the system to meet the greater demands placed on it probably won't be a problem. Compaq describes the ability to tailor the capacities of its computer system to the demands of its users as "scalable performance." This extends the life expectancy of the system before it becomes time to upgrade to a more powerful CPU.

Scalable performance makes the Systempro immune to the untimely death from rapid obsolescence that has plagued the personal computer industry since its inception, and is also the system's most salient selling feature. And while it is impossible to recommend the Systempro with the Novell, LAN Manager, and SCO Unix upgrades unfinished, it should be equally impossible not to consider the Systempro as



FACT FILE

Compaq Systempro

Compaq Computer Corp., Box 692000, 20555 SH 249, Houston, TX 77269-2000; (713) 370-0670.

List Price: With 33-MHz 80386, 4MB RAM, 240MB hard disk, 1.2MB 5.25-inch floppy disk drive, \$15,999; with two 33-MHz 80386s, 12MB RAM, 840MB hard disk, 150/250 MB tape drive, 1.44MB 3.5-inch and 1.2MB 5.25-inch floppy disk drives, VGA monitor, 80387-33 coprocessor, Weitek 3167-33 coprocessor, DOS 4.01, OS/2 1.1, 2,400-bps modem, technical reference guide, \$42,356.

In Short: The Systempro is a powerful file server featuring dual-processor support, memory expansion to 256MB, Compaq's new Intelligent Drive Array, a maximum 1.6 gigabytes of internal disk storage, and seven EISA slots in a carefully constructed tower case. It defines the direction of the PC industry for the 1990s.

CIRCLE 601 ON READER SERVICE CARD

your next file server once these operating system revisions are covered in shrink wrap.

Robert W. Kane is a project leader at PC Labs. Matt Ross is an assistant editor at PC Magazine.

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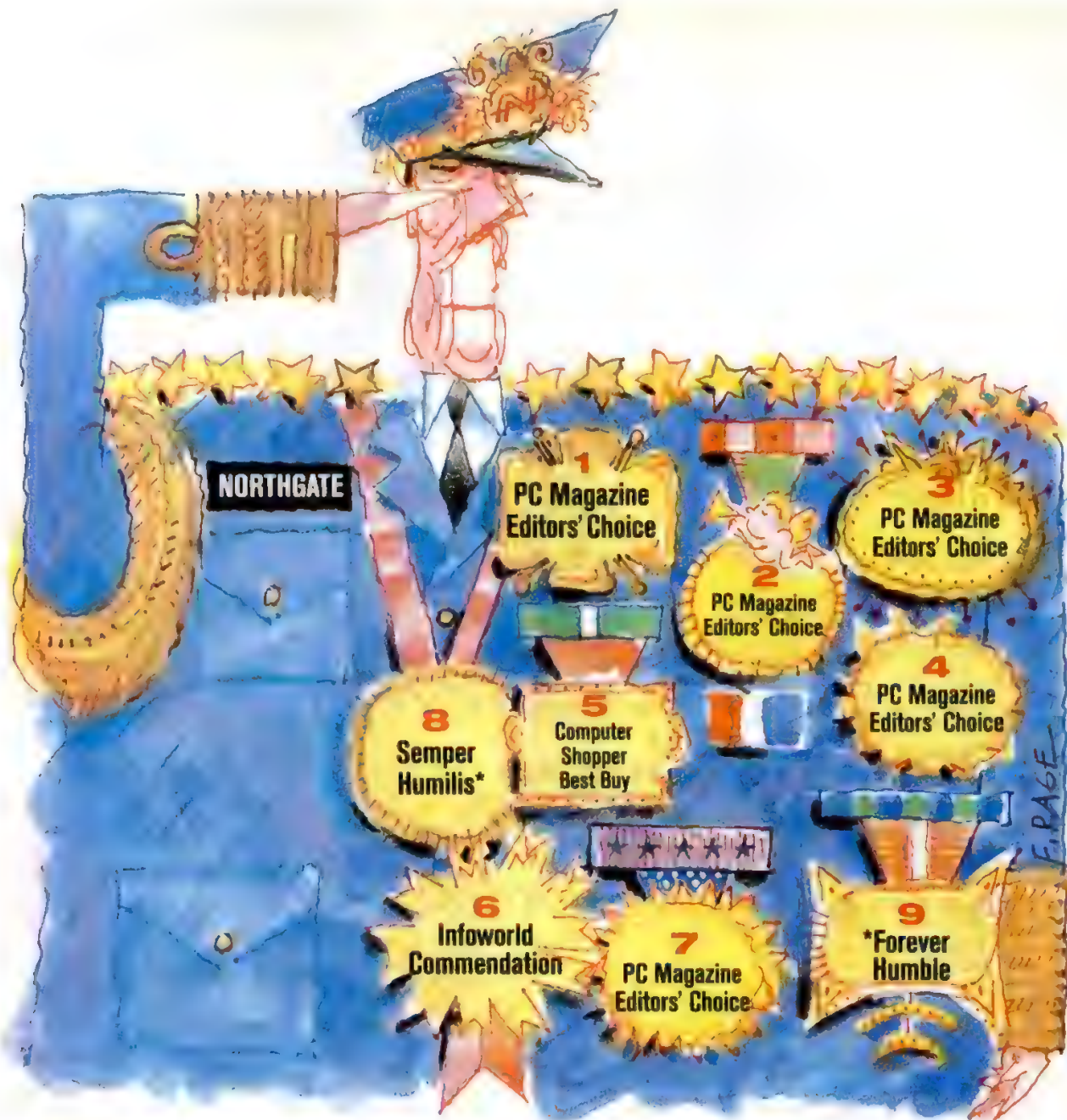
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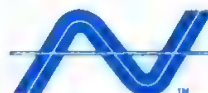


The Highly Decorated General Northgate

A bit pushy? Not at all. General George Patton would, on occasion, walk around with all of his medals in place. So would Generals Douglas MacArthur and Dwight D. Eisenhower, when the spirit grabbed them.

And Samuel F.B. Morse, father of an earlier form of communications, before the world became computerized. (If you think we're making this up, check out Morse's be-medaled photo on the back page of this special Northgate insert.) In the meantime, we could go on and on with the reasons to buy a Northgate system, but we thought the awards said it better than we could.

1. PC Magazine "Editors' Choice" award: 80286 SuperMicro. (PC Magazine, January, 1989)
2. PC Magazine "Editors' Choice" award: 80386 Elegance 20 MHz. (PC Magazine, May, 1989)
3. PC Magazine "Editors' Choice" award: 80386 Elegance 25 MHz. (PC Magazine, May, 1989)
4. PC Magazine "Editors' Choice" award: 80386 Elegance 33 MHz. (PC Magazine, October, 1989)
5. Computer Shopper "Best Buy" awards, three years in a row, based on a vote of the magazine's readers. • Best Buy — complete computer system • Best Buy — overall (all products advertised in the magazine) • Best Buy — Input device: Northgate Omnikey Keyboard.
6. Infoworld. In April of 1989, they saluted Northgate's Elegance 386/25 with the headline: "The Elegance 3000 among the fastest 25-MHz systems" (Infoworld, April 10, 1989). In November, in their review of our Elegance 386/33, they said the following: "Northgate's Elegance 386-33/2000 computer is a top product in most of our scoring categories including value, where it earns just the second excellent mark we've awarded to 33 MHz systems." Overall rating 9.1, their highest ever.
7. PC Magazine "Editors' Choice" award: Northgate's Omnikey Keyboard. 8. "The Northgate Humility award" given to the most modest computer company in Plymouth Minnesota. So there you have it. And the year is still young. Northgate: "Semper Humilis." (Forever Humble).



NORTHGATE COMPUTER SYSTEMS, INC.
13705 First Avenue North
Plymouth, Minnesota 55441-41000
1-800-548-1993

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E l e g a n c e



PHOTO: HARRY LANGDON

THE NORTHGATE 386 33 MHZ ELEGANCE SYSTEM

- *"1a. Refinement and grace in movement, appearance or manners.
b. Tasteful opulence in form, decoration or presentation.
2. Something that is elegant." (American Heritage Dictionary)

You said it.

Since at least three of the medals garnered by General Northgate were for our highly acclaimed Elegance series (triple Editors' Choice awards from PC Magazine, for example), we thought we'd show you what the machine looks like and give you a few specs in case you might be inclined to buy this elegantly designed state-of-the-art computer.

First of all, to photograph an elegant machine... you need an elegant photographer. So we went to the most highly respected lensman in Hollywood: Harry Langdon. He normally lights and shoots such famous faces as Linda Evans, Victoria Principal, Cher, Arnold Schwarzenegger and Diana Ross, to name just a few. So shooting a different pretty face like a Northgate Computer is all in a day's work for Harry. For one thing, Northgate doesn't need a hairdresser.

The Elegance series to your left comes in three versions: The 20 and 25 MHz models, and our top of the line/highest performance Elegance: the 33 MHz which earned a 9.1 rating in Infoworld.

The price of the complete 386™ 33 MHz Elegance system pictured: \$5995.00. (Of course, you can buy a fully configured Elegance system starting at \$3395.00.)

The only thing more impressive than the price is the tech support which comes along with our usual 1 year parts and labor warranty. Did we mention that we also ship you replacement parts, should they be needed, overnight at our expense?

And that our tech support people are actually here for you 24 hours a day, every day, every night?

Put us to the test: give us a call some night at midnight. Or 3:00 AM.

Now to the specs:

Technobabble*

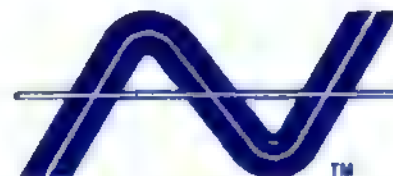
**Seemingly endless Technical specifications, without which you aren't about to buy this machine no matter how many awards it's won.*

Not only that... would this look like a real computer ad without them? Probably not. Here they are:

STANDARD CONFIGURATION

- ◆ 33 MHz Intel 80386 processor.
- ◆ 150 Mb ESDI Hard Drive 16MS.
- ◆ 4 Mb Ram.
- ◆ 64 K SRam Read-Writeback Cache (Optional 256 K Cache available)
- ◆ Zero wait state performance.
- ◆ 1.2 Mb—5.25" floppy drive (also reads, writes and formats low density diskettes).
- ◆ 1.44 Mb—3.5" floppy drive (also reads, writes and formats low density diskettes).
- ◆ Eight expansion card slots
- ◆ 80387 or Weitek coprocessor support

- ◆ Two serial ports and one parallel port (two with monographics systems)
 - ◆ 14" Multifrequency VGA Color Monitor 1024x768 resolution with 16 bit controller.
 - ◆ Sleek new Elegance 7 drive-bay custom vertical cabinet pictured. (Desktop style optional, save \$150.00.)
 - ◆ Exclusive award winning Omnikey Keyboard.
- 24 Hr 7-days a week tech support: unlimited toll free phone.
Additional Technobabble available upon request



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386 IS A TRADEMARK OF INTEL CORPORATION

And for the newest member of the Northgate 386 family, open up this fold-out.

Northgate Slims Down!



Slimmer. Trimmer. The world's smallest 386, standing not even as tall as America's favorite diet cola. Obviously Northgate has lost a few pounds.

At least in the 386/20 pictured above. But it hasn't lost anything else. How do we pack a 20 MHz real 386 system with a 40 MB hard drive into this space saving, smallest 386 ever introduced?

We do it.

It comes with a VGA monitor and all the usual Northgate guarantees.

Slim price too: \$2,399.00 for the entire system. Let's see the competition match this.

Come to think of it...there is no competition. This is one of a kind. A Northgate original. If you're thinking of slimming down, call 1-800 548 1993, and we'll tell you more about it.

Of course we still make the bigger 386. It's up to you.

Northgate Computer Systems: regular or diet.



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1-800 548 1993



THE NORTHGATE OMNIKEY/PLUS

Keyboards have come a long way from the telegraph key to the Omnikey.

On May 24, 1844 Samuel F. B. Morse, father of the Telegraph, typed out the first message ever sent over a wire: "What Hath God Wrought?"

He didn't exactly type it. He tapped it.

Samuel F. B. was a great inventor, but he was working at a disadvantage; he only had one key. Think what might have happened if he'd had the full Omnikey Plus keyboard, pictured above?

He might have invented the Computer.

In the meantime, you may not realize that Northgate *did* invent a key of its own: the F-13 key, which we'll explain shortly. This was recently pointed out by the Computer Editor of The New York Times, Peter H. Lewis, in the Jan. 2, 1990 edition. There, in The Science section, was a very nice review of Northgate's Omnikey, which carried the headline: A KEYBOARD WITH A DIFFERENCE.

Mr. Lewis told how he recently got his hands on Northgate's keyboard and, as a result, replaced his old "mushy keyboard...with the crisp Omnikey Plus."

"We like it a great deal," stated Lewis.

Two days into the nineties, and already

Northgate's upstart Omnikey Plus, was getting raves from the N.Y. Times. In the laid-back, conservative style of The N.Y. Times, "we like it a great deal," may be considered a rave.



SAMUEL F.B. MORSE
(ONE KEY BUFF)

As long ago as August, 1988 a reviewer named Burton L. Alpers (Andrew Seybold's Outlook On Professional Computing) put it this way: "Northgate got it right. They have combined the best features of the I.B.M. keyboard layout with outstanding keyboard feedback. It's like coming home again, but better. In the first place, all the keys are where they should be...most important, all the function keys are back where they belong, on the left



TELEGRAPH KEY (CIRCA 1920)

side, in the same arrangement as the original PC keyboard.

As a point of reference, on a subjective 1-10 scale of mush to well defined feedback, I would rate the Compaq keyboard as a 1, an I.B.M. keyboard as an 8, and a Northgate Omnikey/102, as a 10."

What Hath Northgate Wrought?

So there you have it: Northgate up there right alongside Mary Lou Retton, a perfect 10.

Now to the previously celebrated F-13 key.

As Mr. Lewis pointed out in the Times, the F-13 key causes the period and comma keys to produce periods and commas in both upper and lower cases. No more shifting up and down stuff.

You might want to consider owning this extraordinary keyboard (in either of two models: The Omnikey/102, priced at \$99.00, or the Omnikey/Plus at \$119.00), which didn't arrive in time to help Mr. Morse. We are here to help you, however, 24 hours a day, seven days a week. Let's see them match that down at your



OMNIKEY 102 (CIRCA 1990)

neighborhood computer store.

Just call 1-800-526-2446, and we'll tell you more about this amazing keyboard which comes with a 10-day, no questions asked, money-back guarantee and a three year unconditional warranty. Like General Northgate, Morse apparently liked to be photographed with all his hardware displayed, as you can see on the actual archival photo at left. That's nice.

Of course the Omnikey has won a few medals too. For example:

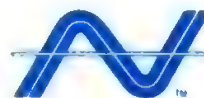
- PC Magazine "Editor's Choice": December, 1989.
- Computer Shopper Magazine "Best Buy," November, 1989.

It has also been declared the "Official keyboard of Chaos Manor" by Dr. Jerry Pournelle of Byte Magazine.

Why not make an Omnikey *your* official keyboard?

Just call Northgate and we'll take it from there.

Medals shmedals. Once you plug in your new Omnikey, you'll find out what Northgate has wrought.



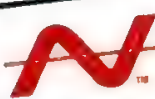
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as \$40/month*



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COMPUTER
SYSTEMS, INC.**

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JOHN J DOE

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Use the Northgate Big 'N' credit card and avoid the "payment crunch."

Simply fill out the Big 'N' request, and send it in. Prompt approval assured.

Once you're approved, simply call our TOLL-FREE number and one of our expert system consultants can help you design the Northgate System which will best suit your needs, and it will be shipped to you right away.

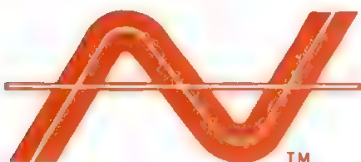
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BIG 'N' REQUEST FOR CREDIT

NOTICE TO WISCONSIN APPLICANTS

You must disclose your marital status.

- ☐ married
- ☐ unmarried
- ☐ legally separated

A married person may apply for individual credit. I am applying for (please check appropriate box):

- ☐ **JOINT CREDIT** with another person. Complete entire application.
- ☐ **INDIVIDUAL CREDIT** but rely on income or assets of another person as a basis for repaying the credit requested. Complete entire application.
- ☐ **INDIVIDUAL CREDIT**. Complete sections "a" and "b" only.

Please complete all appropriate sections, providing at least two year's residence and employment history. This will enable your application to be processed as quickly as possible. If you are self-employed, please be sure to complete section "d".

Applicants must be 18 years of age or older.

a. Your Personal Information

Requested Line of Credit \$

Your Name: First		Initial		Last		Date of Birth: Mo Day Yr		Social Security Number:	
Present Address: Street		Apt. #		City		State		Zip	
Date of Residence: Month		Year		Monthly Payment: \$		Buy		Rent	
Previous Address:		Date of Residence: From		To		Gross \$		Net \$	
Your Employer: (If self-employed, see rear panel)		Date of Employment: Mo Yr		Position:		Gross \$		Net \$	
Employer's Address: Street		City		State		Business Phone:			
Previous Employer:		Address:		Date of Employment: From		To			
Income from alimony, child support or separate maintenance payments need not be disclosed if you do not wish to have it considered as a basis for repaying this obligation.		Other Income:		I have received since: (Date)		Monthly Income Gross \$		Net \$	
Name and Address of Nearest Relative Not Living With You:									

b. Credit Information

Include joint applicant's information, if joint account requested.

Bank Account:		Bank Name		Address		☐ Checking		☐ Savings	
Bank Account:		Bank Name		Address		☐ Checking		☐ Savings	
Bank Loan Reference:		☐ VISA		Payment		Balance			
Bank Card Reference:		☐ Mastercard							
Other Credit Card Reference:		Account No.		Expires:					
Driver's License No.		State		Expires:					

c. Joint Applicant's Personal Information

If you are a married Wisconsin applicant, you must provide your spouse's information below, even though your spouse may not be signing this contract.

Joint Applicant's Name: First		Initial		Last		Date of Birth: Mo Day Yr		Social Security Number:	
Address: Street		Apt. #		City		State		Zip	
Employer:		Date of Employment: Mo Yr		Position:		Monthly Income: Gross \$		Net \$	
Employer's Address: Street		City		State		Business Phone:			

d. Self-Employed Information

Complete this section only if you are self-employed.

Business Name		Proprietorship		Corporation		Partnership	
Business Address		Business Telephone					
Description of Business		Your Position		In Business Since			
Your annual income from business		Business' annual income (gross)		(net)			
You must provide at least one of the following:							
1. Business Name		Telephone		Personal Banker's Name			
2. Accountant's Name		Telephone					
3. Financial statement on business attached.							

PCM410

Complete this request and mail to Northgate today!

*Based on purchase price of \$1,299.00 on the Big 'N' revolving charge. Prices subject to change without notice. Offer not valid for APO or FPO customers.

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ILLUSTRATION: JEFFREY TERRESO

Can They Eliminate Fax Machine Bottlenecks?

by Frank J. Derfler, Jr., and Tom Unger

New York City, Monday, 8:30 A.M., and you're in the office early because you need to use the fax machine. You grab your coffee cup and rifle through the documents that absolutely, positively have to be in California when the regional office opens. You think, "No sweat; I've got *hours* to spare."

Then you see it: The Fax Line. Eleven people standing listlessly in a row, sipping cold coffee while your department's only fax machine slowly, maddeningly cranks out fax after incoming fax. The receptionist sits on the floor, hopelessly sorting through the weekend's mountain of sheets. Worse yet: you're told the line for the fax machine over in Marketing is twice as long, and that's because the one belonging to Sales gave up in a cloud of smoke sometime last week. Maybe you'll get those documents out to California by afternoon. Maybe.

LAN FAX GATEWAYS

In this roundup, *PC Magazine* presents eight ways to get your faxes on-line without making you wait in one. Nowadays, chances are that if your office has more than one PC, those PCs are networked. And while in most cases the standalone fax machine is best for receiving faxed documents, a fax card installed in your network can make faxing out efficient again.

ALTERNATIVE ROUTES

Seven of these fax solutions are board-and-software packages that must reside on a separate PC on your LAN. Some require that the separate PC acting as your fax server be dedicated to the task of receiving and sending faxes, and some will allow you to run other software on the fax server while fax operations run in the background. Remember that none of these fax boards can be added to your file server. One package is a standalone box that connects both to your phone lines and to your LAN server. These eight packages present the only hardware-and-software combinations available to make your network fax-capable.

Why go to the trouble of installing yet another fax device when you've already paid thousands of dollars for the last one? After all, public fax services such as MCI Mail do an efficient job of accepting your ASCII text files via modem and sending them out via fax. And sending multiple copies this way is particularly easy. But mail services, while convenient and fast, won't send images—no sales charts, no productivity projection graphs, no CAD-generated drawings of your proposed office renovation.

And if you want to send PC-generated images via a standalone fax machine, you must put them on paper and have the fax machine scan them back into its own digital format, introducing all the distortion inherent in such physical processes. Worse yet, you're back to standing in line to send your faxes.

One solution might be to install a fax board in your PC. This would allow you to fax text as well as images generated and manipulated by a graphics package—including your company letterhead and your signature.

Such an arrangement removes the middle steps from the fax process but suffers from several drawbacks. Receiving and using incoming faxes isn't easy. Each faxed text file takes 50K to 100K of mass storage—and faxes with graphs or pictures in them can be many times as large. If you

receive five or six faxes a day, you'll be begging for a new hard disk by week's end. And you'll need at least 1.5MB of memory in your laser printer to print out most of the images you receive. Finally,

A major advantage of the LAN fax server system is that you send an image to the file server and then forget it.

few fax hardware and software packages do their work in background mode. You're likely to be sitting idly by while the PC makes its call and sends the image.

Most important, giving every office PC its own fax board can be expensive. Aside from the cost of the hardware and software and their installation, every fax board virtually demands a phone line of its own. Beyond the individual costs, adding phone lines can require an expensive upgrade of the PBX or higher monthly Centrex charges. Add to this the cost of laser printers, scanners, and other associated costs, and what was once an efficient method of information transmission becomes an expensive nightmare. But what if there were a way to share your fax-via-PC resources and remove—or at least speed up—the bottleneck at your fax machine without excessive cost or loss of productivity? Enter the LAN fax solution.

ONE BOARD SERVES ALL

It's easy to share a single fax board by installing the board in a single PC acting as a fax server in your LAN. You can establish a LAN fax server on any type of local area network, regardless of the cabling, transport protocols, or LAN operating system being used. If your network already has a file server that allows shared directories, you can install a LAN fax board in a workstation on your LAN.

All the products we review in this roundup—with one notable exception—work on the same principle: the fax

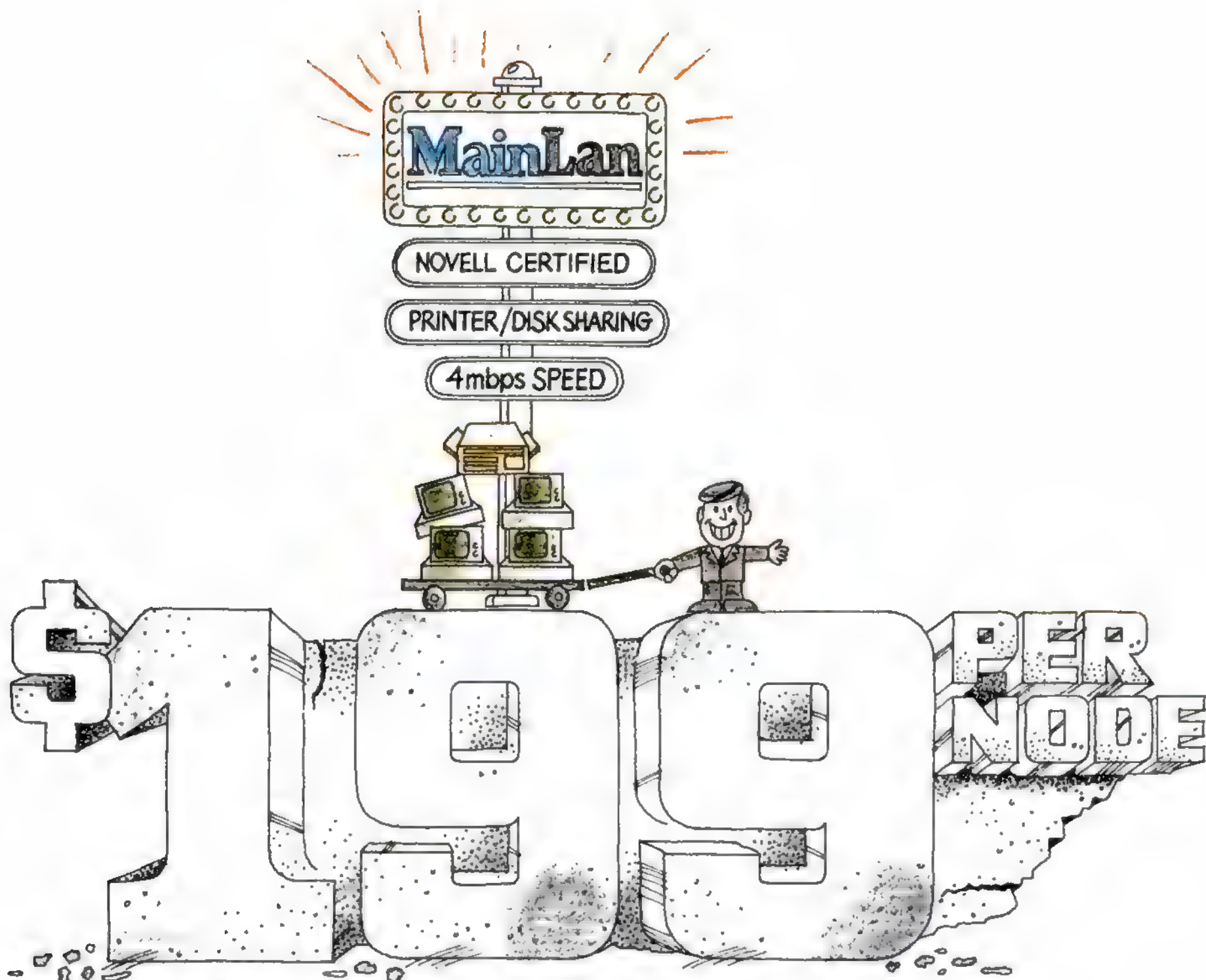
server is a PC on the network containing the fax board, transmission software, and software that manages a shared subdirectory on the file server. A scanner connected to the fax server can create image files that networked stations can share through the file server.

The notable exception to this layout is Castle's \$3,995 FaxPress facsimile server. This small gray box is a complete computer, internally programmed to act as a fax server on a Novell *NetWare* network. A first-class plug-and-play system, the FaxPress lets you avoid the installation hassles of having to find nonconflicting IRQ and memory addresses for the fax board, as well as the excess cost of relegating an otherwise useful PC to the fax server role. Castle's package includes phone-line connectors, an Ethernet cable, and a printer.

The workstations on a LAN with a fax server run software that prepares fax messages for transmission and displays incoming messages. A major advantage of the LAN fax server system is that you send an image to the file server and then forget it. Text and images are converted to faxable format at the fax server and then transmitted, freeing you to do other work. You'll never have to twiddle your thumbs while waiting for the "message conversion in progress" or "transmission in progress" message to leave your screen. Different products handle these chores with varying degrees of complexity and automation, but all are designed to take the faxing burden off your PC's shoulders.

In the simplest products, like the PC Race, you enter transmission information at the beginning of an ASCII file and then transfer the file to a particular subdirectory on the file server, where the fax server software locates it and sends it out. More-complex products, such as the FaxPoint Facsimile Pac/LAN, include built-in telephone directories, mailing lists, and comprehensive message-preparation and -viewing utilities. For those who prefer a graphical user interface, the AT&T PagePower and PureData's PureFax run in the *Microsoft Windows* environment.

Another fax-to-LAN tie-in operates in conjunction with electronic mail products such as *Cross+Point*, *Higgins*, and *Office Works*. These e-mail packages let you mix addressees at various e-mail destinations with addresses served by fax machines. The messages go into the proper transmission path with no special work on the part of the originator and are delivered accord-



Top Network Performance at a Rock-bottom Price!

“MainLan is as easy to install as a VCR!”

—PC Magazine
(Connectivity Labs)

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—Personal Computer World

“... (Novell compatibility) sets it apart from the rest of the pack.”

—Computer Reseller News

PC

VERDICT				
PERFORMANCE	○	○	●	○
EASE OF USE	○	○	○	●
DOCUMENTATION	○	○	○	●
VALUE FOR MONEY	○	○	○	●

—PC Magazine, UK Edition

Low price and big-system features make MainLan today's outstanding value on the LAN scene. It provides disk/printer sharing, as well as file transfer, E mail, data security and network management.

Install MainLan in about 15 minutes, and you can run your multi-user applications right away!

- Easy operation: menu prompted, simple commands
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- 4 mbps transfer rate (about twice that of competitive LANs)
- Low RAM overhead: as little as 50k

- Peer-to-peer communication: share any disk or printer on the network (no dedicated file server is required)

- 30-day money-back guarantee

- Free Hotline tech support!

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ingly. (See the sidebar "E-Mail Packages with the Fax Touch.")

SERVER LIMITATIONS

Is this the ultimate solution to your fax slowdown? Not really. You should be aware that while a networked fax server can take a good deal of the strain off your standalone fax machine, it imposes its own limitations.

One major stumbling block is in the fax message itself, which doesn't support individual addressing. Because the software can't read the fax and determine to whom it is addressed, it can only dump the file into a subdirectory. At that point, a set of human eyes must view the message in order to figure out to whom it belongs. It should be simple enough to have a designated employee routinely check the incoming files and then transfer them to their proper directories on the LAN, but in resource-poor situations this may prove to be impracticable.

Another difficulty makes itself plain when you first try to read the faxes that arrive in your LAN subdirectory. Faxes that originated from another digital source, such as a computer, will appear on your screen much as they did on the sender's. But reading faxes originated from scanned images or sent from other fax machines can be an exercise in frustration. For scanned text, we found screen readability (or lack of readability) to be equally poor for all the boards we tested, and that's why you won't see them judged in that regard in these reviews. Likewise, output quality is more a function of the printer on which the fax is reproduced than the fax board that sent the data. In that regard, a high-quality laser printer will generally reproduce a faxed image better than a standard thermal fax machine.

Faxed text is inherently hard to read because of the process of digitizing a scanned image—a version that will never be better than the paper copy from which it was created and the scanner that read it. You can enlarge it via your fax software's zoom capabilities, but then you can only read small portions of text at any given time. You may find yourself jockeying all over the page just to read full sentences, and if your computer is poky you may be at it all day. You could print the message, but you'll have to find a big-memory laser printer, and you'll find yourself waiting all over again.

The bottom line? If you have a network and a fax machine overburdened with out-

CONNECTIVITY

LAN FAX GATEWAYS

going messages, a high-speed, low-cost fax server attached to your LAN will most certainly allow you and your employees to make better use of your time. In many cases it would be worthwhile to set up a low-cost LAN that could take advantage of the easy operation these systems provide. And while a LAN fax server probably won't turn your standalone fax machine into a boat anchor, it will sink standing in line for good.

AT&T INFORMATION SYSTEMS

AT&T PagePower

by Paul Ferrill

AT&T's LAN fax server may not do all of your network fax chores, but it does do windows. In fact, the *Microsoft Windows* environment provides a good home for the \$1,295 PagePower fax package, which includes the Faxcon-20 board and all its associated software (*PagePower*, Version 2.1). The only thing missing is your own copy of *Microsoft Windows*, Version 2.01 or later.

The Faxcon-20 fax board is fully compatible with the CCITT Group II and Group III standards. Its detailed installation manual includes instructions for using the board with a regular dial telephone line or through a PBX, and drawings in the manual make hardware setup a breeze.

In addition to the board itself, AT&T offers an \$895 scanner with *PagePower Scan* software. The Model SC-60 scanner accepts documents up to 9 inches wide and connects to the PC through its own interface board. This board works in conjunction with the *PagePower* software to provide complete LAN fax capability for not much more than you would pay for a mid-priced fax machine. When the scanner is attached to the LAN fax server, its images are available to all network stations.

The *PagePower* software can be installed for either standalone or network operation. In standalone mode, only the computer with the Faxcon-20 and SC-60 installed has access to those tools. In the network mode, all machines on the network have access to that PC, which acts as a dedicated fax server. Unfortunately this means the machine can't simultaneously perform as a fax server and run other network application software. *PagePower*

software is available in versions compatible with NetBIOS networks, including AT&T's *StarGroup* and Novell's *NetWare* running the NetBIOS emulator.

AT&T also includes *PagePower Draw*, a drawing package that enables you to create graphics, charts, and text or modify scanned images. Its Create Fax option places the image in your fax out-box.

AT&T's *PagePower* fax software sends or schedules faxes for transmission. Any file created with either *PagePower Scan* or *Draw* can be sent as a fax, and any Tagged Image File Format (.TIF) files can be sent, too. *PagePower* also sends ASCII files as well as files created with the more popular word processors, including *WordPerfect*, *WordStar*, *Microsoft Word*, *MultiMate*, and *PFS:Professional Write*. A fax phone book included in the program makes it easy to call other fax machines. And AT&T's *PagePower* software works with any printer that *Microsoft Windows* supports, because all printing takes place within the *Windows* environment. AT&T provides additional fonts for use with an HP LaserJet printer.

For those who would rather type their commands instead of using *Windows*, AT&T provides a series of command-line programs that allows users to send and re-

**FACT FILE**
EDITOR'S CHOICE

AT&T PagePower
AT&T Information Systems, 1 Speedwell Ave., Morristown, NJ 07960; (800) 247-1212.
List Price: Faxcon-20 board and *PagePower* software, Version 2.1, \$1,295; Model SC-60 scanner and *PagePower Scan*, \$895.
Requires: A LAN using DOS 3.1 file- and record-locking calls, with a shared hard disk in a file server and one PC to act as the fax server. 120K RAM on fax server, 25K RAM on workstation.
In Short: A versatile, *Windows*-based fax system for a standalone PC or a network, AT&T *PagePower* works with Novell's *NetWare* running NetBIOS or with other NetBIOS-compatible networks. It includes a drawing package to create and edit fax messages. With the optional scanner attached to the LAN fax server, this system does a good job of replacing a standalone fax machine for each LAN user.

CIRCLE 426 ON READER SERVICE CARD

ceive faxes, scan documents in and fax them out, schedule faxes for transmission, and view and print faxes.

The AT&T *PagePower* package, with its *PagePower Draw* software and optional SC-60 scanner, is a complete and useful product that should be considered by anyone looking for a no-compromise LAN fax gateway solution.

All the power of The Software Link's PC-MOS operating system. All the benefits of both individual and networked PCs.

All in one high-performance, low-cost, multi-tasking system. With no terminals and no additional PCs — unless you want to optionally use your old XT's or AT's.

The UnTerminal™ UnNetwork.™

It's the ideal multiuser system for personal computer users.

UnTerminal monitor-keyboard workstations cost less than terminals. Less than text-only "intelligent I/O" solutions. Less than fiber-optic graphics solutions.

An independently operating UnTerminal workstation outperforms them all. With faster

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Inexpensive monitor-keyboard workstations replace costly terminals and PCs on the UnTerminal UnNetwork.™ Run multiuser and popular PC programs at the same time — with no terminals or PCs — or use any XT's and AT's you happen to have.



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The UnTerminal Connect Card makes an XT or AT into a multitasking, multiuser workstation.

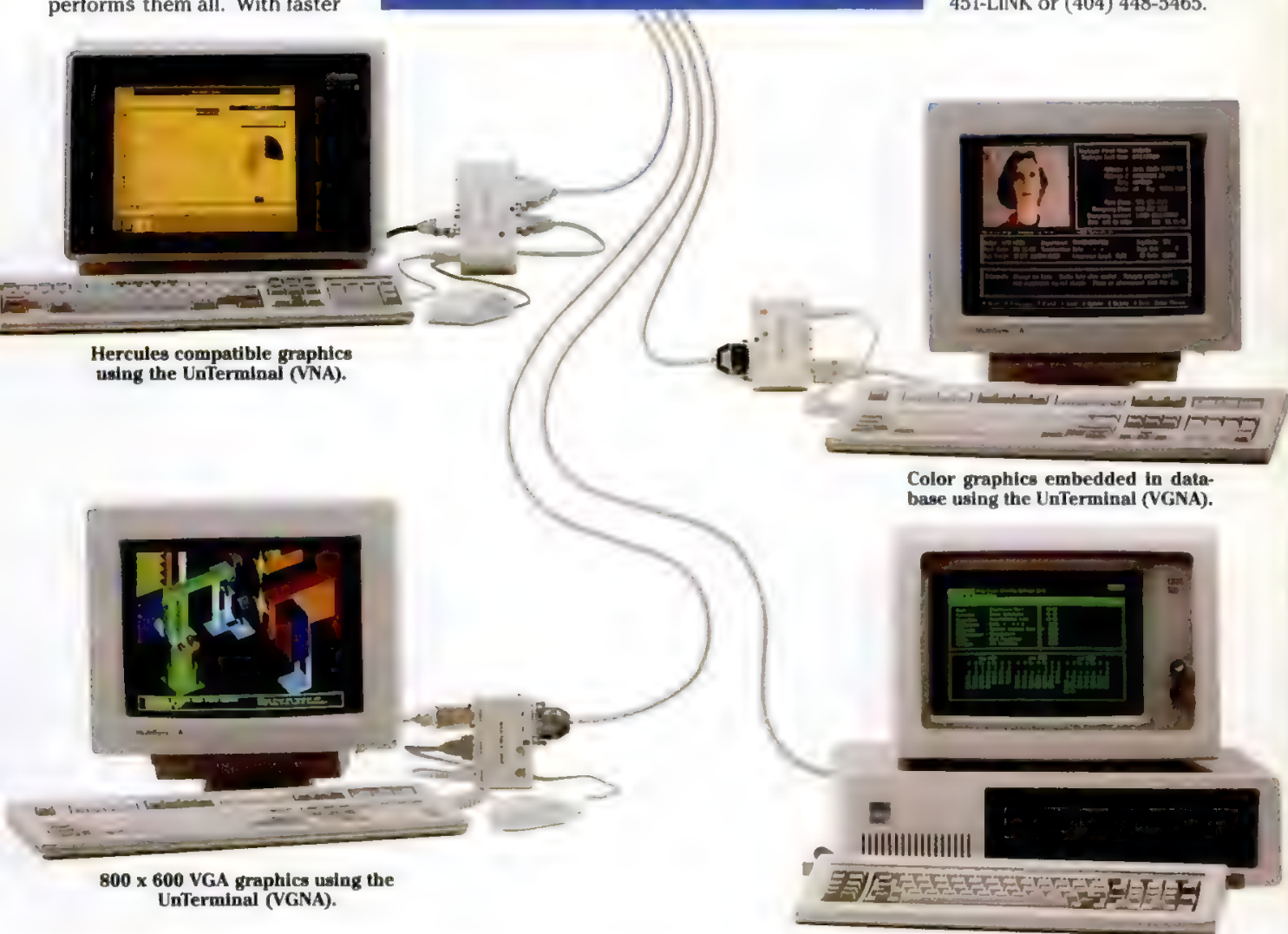
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The Software Link's PC-MOS multiplies the power of your PC. Why pay extra just to get the boxes? You can run up to eight color or 16 monochrome UnTerminal workstations per system — and save thousands.

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The Software Link, Inc.*

For more information, call:
The Software Link, Inc. at (800) 451-LINK or (404) 448-5465.



Hercules compatible graphics using the UnTerminal (VNA).

Color graphics embedded in database using the UnTerminal (VGNA).

800 x 600 VGA graphics using the UnTerminal (VGNA).



The PC-MOS UnTerminal

PC-MOS MULTIUSER SYSTEMS WITHOUT TERMINALS

CIRCLE 393 ON READER SERVICE CARD

The Software Link, Inc., 3577 Parkway Lane, Norcross, GA 30092.

Phone: (800) 451-LINK or (404) 448-5465, FAX: (404) 263-6474, Telex: 4996147 SWLINK.

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of your nearest Hayes dealer, call us at 1-800-635-1225.

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Hayes

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CIRCLE 136 ON READER SERVICE CARD

Communications system machines.

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CASTELLE

FaxPress

by C. G. Milligan

Unlike other LAN fax solutions, Castelle's FaxPress won't disappear inside your fax server. This standalone unit costs \$3,995 with 2.5MB RAM and \$4,395 with 4.5MB, and it hardly takes up enough space to cramp your faxing style—it fits easily on a bookshelf.

FaxPress attaches to a Novell LAN via standard Ethernet connections. If your network is based on ARCnet or Token-Ring topologies, an Ethernet card in your server will provide an internal bridge connection to the standalone "box." Hardware installation is as easy as plugging the unit into the wall, attaching an Ethernet cable, plugging in the standard RJ-11 telephone-wire connection, and connecting an optional laser printer. Automated installation of the *FaxMenu* software is surprisingly simple; it requires only a minimum of interaction with the network manager to set up user IDs, passwords, and printer information.

Standard print jobs from network stations as well as faxes can be produced on the printer attached to the FaxPress. After business hours, incoming faxes are either printed or saved to files. Optional print routing sends faxes out to any printers attached to the network. FaxPress supports standard Novell print utilities such as Nprint, Capture, and Printcon. While Pconsole does not display queued print jobs submitted by *FaxMenu*, the *FaxMenu* utility does provide total queue control for operators and supervisors.

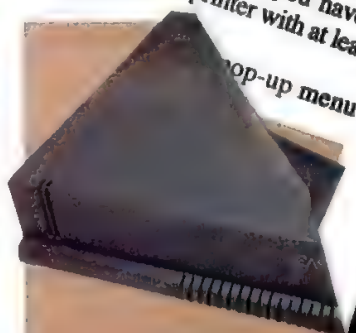
Users can send faxes from any workstation in the network, and the *FaxSetup* driv-

CONNECTIVITY LAN FAX GATEWAYS

er that enables a workstation to communicate with the fax server requires only 2K of memory. The *FaxMenu* utility provides users with a simple menu-driven way to send faxes, view or print an incoming fax, and maintain telephone directories. Viewing a fax is easy, with standard cursor controls for paging, moving up and down, or panning from side to side. The Z key zooms your view in or out. *FaxMenu* also has a section for routing faxes, posting notices to users, and confirming a user's receipt of incoming fax mail.

There is no graphics editor for FaxPress, and files must be in standard ASCII format or PCL (Hewlett-Packard's Printer Control Language) to use the *FaxMenu* program. This presents few problems, as most of the popular applications, such as *Ventura Publisher*, *WordPerfect*, *Excel*, and other graphics-capable programs, already support the LaserJet printer. Documents are converted automatically to fax format for transmission. FaxPress supports special high-quality fonts, multiple

font size
tion printer
LaserJet or
1.5MB of me
And high-resolu-
The option's printer with at least



Castelle's FaxPress is the only LAN gateway in the form of a standalone rather than an add-in board; it attaches to the LAN via Ethernet connections and simply plugs into the wall. The price is \$3,995 model with 2.5MB RAM.

provides fax transmission control for whatever application you're in. *FaxPOP* is a TSR program requiring 50K RAM. Once the pop-up is activated and a phone number is selected, the next print command in the application you're using sends the file to the fax server for transmission. User-assignable hotkeys for *FaxPOP* assure compatibility with most applications.

Fax transmission time and date control let you schedule when a fax is to be sent, and transmission confirmation and logging

Today's LAN fax gateway technology hasn't come quite far enough to make you want to throw out your fax machine. The systems we reviewed make sending faxes from a network a breeze but do less to revolutionize the receiving process.

A fax server can operate on most types of local area networks. This is a PC equipped with a fax adapter board, running software that moves received faxes into and outgoing faxes out of special subdirectories on the file server. Some products demand a fax server that is dedicated to this one task.

Because incoming fax messages don't contain individual addresses, a fax administrator typically reviews each received fax and either puts it into an appropriate subdirectory or attaches it to an e-mail message for the recipient. Individual client PCs need special software to view received fax messages and print them on the shared printer, but many applications can create outgoing fax files.



FACT FILE

FaxPress

Castelle, 3255-3 Scott Blvd., Santa Clara, CA 95054; (408) 496-0474.

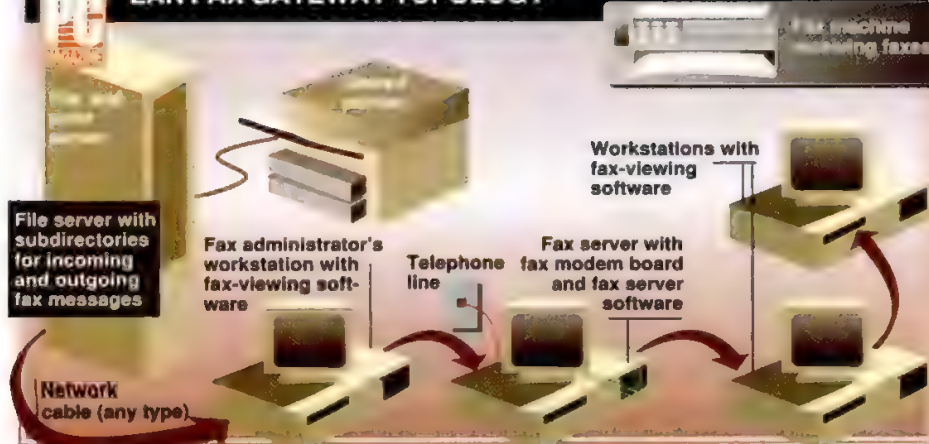
List Price: With 2.5MB RAM, \$3,995; with 4.5MB RAM, \$4,395.

Requires: A Novell NetWare network with an Ethernet connection. 43K RAM on workstation.

In Short: A standalone Novell-compatible LAN fax unit that automates many of the tasks currently assigned to your fax machine. Castelle's FaxPress includes simple but powerful *FaxMenu* utilities for ease-of-use.

CIRCLE 429 ON READER SERVICE CARD

LAN FAX GATEWAY TOPOLOGY



CONNECTIVITY

LAN FAX GATEWAYS

help track job completion and fax receipt. User passwords and three levels of user privileges provide system security.

The FaxPress software is supplied on two 360K floppy disks, but Castelle recommends that the file server have 20MB of space free on its hard disk, because the average fax file will use 50K to 100K of disk space. Fortunately a "storage space reclamation" function enables the supervisor to easily erase routed faxes, or notices to specific users or groups, based on the age of the fax or notice. Private and public phone directory files are in standard ASCII text, allowing their manipulation by a simple text editor such as EDLIN, or by the FaxPOP or FaxMenu utilities.

Castelle's FaxPress is a wise investment for LAN administrators who don't have PCs to spare for the fax server role. The menuing software is simple and powerful enough to please beginners and power users alike. Castelle's documentation is well written and takes a step-by-step approach. Want more? Castelle recently announced a \$495 e-mail add-on package slated for availability early this year, further enhancing this product's overall effectiveness.

FAXPOINT INTERNATIONAL

FaxPoint Facsimile Pac/LAN V1.23

by M. Keith Thompson

While the FaxPoint Facsimile Pac/LAN V1.23 has the distinction of being on Novell's approved product list, it also works with 3Com, IBM, Banyan, and most other networks. This product's broad network support makes it an attractive LAN fax server solution—and at \$648, the Facsimile Pac/LAN is the least expensive product we tested.

On-board the Facsimile Pac/LAN card, a Motorola 6802 processor manages all of the tasks associated with sending and receiving faxes. Facsimile Pac/LAN also includes a DEST scanner interface and support for fax speeds slower than 9,600 bits per second. Options include a Hayes-compatible 2,400-bit-per-second modem and a DES encryption chip.

Installation is blissfully fast and simple. With a variety of I/O addresses available, LAN managers can install the Facsimile Pac/LAN even in crowded PCs. Automat-

ed software configuration is equally simple, requiring you only to answer a few questions about your computer's configuration. In addition to accurate documentation for each type of network, the company

PC FACT FILE

FaxPoint Facsimile Pac/LAN V1.23
 FaxPoint International, 601 Golden Harbour Dr.,
 Boca Raton, FL 33432-2943; (305) 563-3326.
 List Price: \$648.

Requires: A LAN using DOS 3.1 file- and record-locking calls, with a shared hard disk in a file server and one PC to act as the fax server. 160K RAM on fax server, (or 57K RAM with expanded memory), 75K RAM on workstation.

In Short: A powerful, easy-to-use, Novell-approved LAN fax system that lacks some necessities, such as a graphics editor, batch queuing, and even rudimentary security measures. But it does support workstation scanners, and the low price offsets its faults.

CIRCLE 543 ON READER SERVICE CARD

makes available solid on-line help.

FaxPoint's fax management software has several features we liked and a few we didn't. The fax server software saves you money by starting failed transmissions from the last good page sent, but it's not smart enough to scan the queue and send all the files intended for the same destination at once. A useful status report available on the fax server displays the status of each transmission in a window, but the workstations don't see this information. And Facsimile Pac/LAN learns how to correspond with multiple fax machines by reading commands in your text files or in batch files. Including distribution lists as entries in the phone book would be preferable.

Facsimile Pac/LAN supports viewing faxes on Hercules, CGA, EGA, and VGA monitors. The absence of a graphics editor prevents users from editing, scaling, or rotating images. The viewing software does allow you to select a full-screen or zoomed image.

Facsimile Pac/LAN lacks security features, making it even more vulnerable to peering eyes than a real fax machine. Unless you inhibit the read privileges on sub-directories carrying outbound faxes and interpose a human routing clerk, all users can see both the faxes received and those sent. With a real fax machine, at least you can take the original with you after you send it.

Facsimile Pac/LAN

offers network users
a well-integrated
fax alternative.

These complaints aside, the software sports some noteworthy features. In addition to e-mail, Facsimile Pac/LAN integrates word processing and spreadsheets into the fax production loop. An 80K TSR lets you redirect your output to an Epson FX-80 on a phantom printer port, asks you the phone number of the destination fax machine, and then prints the text and graphics on that machine. This transparent design transforms any one of the world's fax machines into a printer.

Facsimile Pac/LAN V1.23 provides network users with a well-integrated computerized fax alternative. Powerful background processing permits scanning, print spooling, sending a fax, and converting a fax to display, all at the same time—and all at a price that's lower than most standalone fax machines.

GLAMMALINK

GammaFax CP

by M. Keith Thompson

It's no surprise that GammaLink, a veteran player in the PC fax card arena, offers a powerful and expandable LAN fax solution. With a flexible hardware-and-software design, the GammaFax CP fax board and *GammaNet* software integrate easily with most LANs, and at \$2,090 the pair is competitively priced.

GammaNet includes easy-to-follow menus with informative status screens, and network managers will appreciate Auto Delete, a disk-space-saving feature. Because fax files are graphical images and take up a lot of space—typically 100K—the *GammaNet* software waits a user-assignable length of time after faxes have been viewed and printed, and then deletes them.

The GammaFax board is powered by a 10-MHz 80C188 chip with 256K RAM, expandable to 512K. It uses only an I/O



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CIRCLE 156 ON READER SERVICE CARD

	SD630	SD700
<i>Microprocessor</i>	80286	80386SX
<i>Operating Speed</i>	12MHz	16MHz
<i>On-Board RAM</i>	640KB; expandable to 1MB on mother-board	2MB; expandable to 8MB on mother-board
<i>Expansion Slots</i>	Five 16-bit; all available	Five 16-bit; all available
<i>MSRP</i>	\$1099	\$1999

The SD630 and SD700. More than affordable.



SAMSUNG

CONNECTIVITY

LAN FAX GATEWAYS

LAN FAX GATEWAYS: SUMMARY OF FEATURES

Products listed in ascending price order

	FaxPoint Facsimile Pac/LAN V1.23	PC Race 96 FAX/modem	AT&T PagePower	PureFax	GammaFax CP	NetFAX	Facsimile Server	FaxPress
List price	\$648	\$795	\$1,295	\$1,550	\$2,090	\$2,090	\$3,900	\$3,995
HARDWARE								
Supports Group III fax speeds	■	■	■	■	■	■	■	■
Micro Channel version available	□	□	□	□	■	□	□	N/A*
Settings controlled through:								
Software	■	■	■	□	■	■	□	■
DIP switches	■	■	■	■	■	■	■	□
Jumpers	■	■	■	■	■	□	■	□
COM port addresses	None	COM1, 2, 3, 4	None	None	None	None	None	N/A*
Can move shared memory address	□	□	□	□	□	■	□	N/A*
RJ-11 connection for voice phone	□	■	■	■	■	■	■	□
Fax operation disconnects voice phone	N/A†	■	■	■	■	■	■	N/A†
Secondary modem	□	■	□	■	■	■	□	□
Document can be scanned while viewing file	■	□	■	□	□	■	□	□
SERVER SOFTWARE								
Works with boards from other companies	□	■	□	■	□	□	□	■
Works as a TSR on the host PC	■	■	■	■	■	■	□	□
Uses IPX to talk to workstations	□	□	□	□	□	■	■	■
Uses NetBIOS to talk to workstations	□	■	■	□	□	■ (NetBIOS version only)	□	□
Uses shared files on the server	■	■	■	■	■	■	■	□
Can print incoming faxes without saving	■	□	■	■	■	■	□	■
Listens for dial tone before dialing	■	■	■	□	■	■	■	■
Logs actions and errors	■	■	■	■	■	■	■	■
Notifies of errors	■	□	■	■	■	■	■	■
Notifies of incoming fax	■	■	■	■	■	■	■	■
Moves through queue if calls are unsuccessful	■	■	■	■	■	■	■	■
Can send multiple documents on a single call	□	■	■	■	■	■	□	□
Restarts failed call from the last good page	■	□	□	□	□	■	■	□
System polls remote fax machines for faxes	□	□	□	■	■	□	■	□
Requests polled station's ID	N/A†	N/A†	N/A†	■	□	N/A†	■	N/A†
Polls only with same-brand systems	N/A†	N/A†	N/A†	□	□	N/A†	□	N/A†
Fax can be scheduled for later transmission	■	■	■	■	■	■	■	■
CLIENT STATION SOFTWARE								
Enlarges and reduces display of received faxes on-screen	■	■	■	■	■	■	■	■
Maximum number of pages received	Unlimited	999	255	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited
Graphics editor included	□	□	■	□	□	□	■	□
Can flip images upside down	□	■	■	■	■	■	■	□
Can rotate images sideways	□	□	■	□	□	□	□	□
Can reverse (mirror) images	□	□	□	■	■	■	□	□
Files converted to fax format before or during call	Before	Either	Before	During	Either	Before	Before	Before
Can import WordStar files	□	■	■	□	■	■	□	□
Can import Microsoft Windows files	□	□	■	■	■	■	□	□

■—Editor's Choice ■—Yes □—No

N/A*—Not available: FaxPress is not an internal adapter but a standalone unit acting as a Novell server.

N/A†—Not available: the product does not have this feature.

CONTINUES

CONNECTIVITY

LAN FAX GATEWAYS

LAN FAX GATEWAYS: SUMMARY OF FEATURES

Products listed in ascending price order

	FaxPoint Facsimile Pac/LAN V1.23	PC Race 96 FAX/modem	AT&T PagePower	PureFax	GammaFax CP	NetFAX	Facsimile Server	FaxPress
CLIENT STATION SOFTWARE								
Can import Lotus Printgraph files	☐	☒	☐	☐	☐	☒	☐	☐
Personal phone book included	☒	☒	☒	☒	☒	☒	☒	☒
Shared group phone book included	☒	☒	☐	☐	☒	☒	☒	☒
Maximum number of distribution lists	Unlimited	5	200	999	Unlimited	Unlimited	50 per level	100
Maximum recipients per list	Unlimited	9,999	200	999	Unlimited	Unlimited	50	Unlimited
Graphics boards supported	CGA, HGC, EGA, VGA	CGA, HGC, EGA, VGA	CGA, HGC, EGA, VGA	CGA, HGC, EGA, VGA	CGA, HGC, EGA, VGA	CGA, HGC, EGA, VGA	CGA, HGC, EGA, VGA	CGA, HGC, EGA, VGA
Scanner supported on workstation	☒	☒	☒	☒	☒	☒	☐	☒
SUPPORT								
800-number telephone support	☐	☐	☒	☐	☐	☐	☒	☒
Cost of technical support	Free	Free	Free	Free	Free	Free	\$390 first year; 15% of purchase price thereafter	Free

—Editor's Choice ☒—Yes ☐—No

ENDS

port (no DMA or interrupts), so the GammaFax has little potential for conflicts with other devices. For offices with extraordinary fax traffic, *GammaNet* supports up to eight GammaFax boards with one fax server. Organizations with bad connections between their offices and the local telephone company can minimize line noise with the board's RJ-45S option, which allows a technician to install line-conditioning devices. Unfortunately, GammaLink chose not to include a scanner interface option.

GammaLink provides adequate installation documentation for the fax server, but configuring the workstations is not quite as simple. And GammaFax requires

you to change some files (both on the fax server and on the workstations) with a text editor—a task made easier in other packages through automated installation procedures.

At the networked PC, a 45K TSR routes all faxes to the fax server and pops up when a fax comes in. From the Send Fax menu, *GammaNet* conveniently lets you list the files in the current directory. A distribution list can be created simply and effectively in an ASCII text file, with phone numbers listed one per line; the file is then saved with an .LST extension.

The *GammaNet* software works on the fax server in both dedicated and nondedicated modes. In nondedicated mode the fax server cannot print faxes automatically and does not convert ASCII files to fax format; instead, you must exit to DOS and manually convert files before faxing them.

To take advantage of the power and flexibility *GammaNet* offers, you have to dive into its command language, which provides a high degree of control over the GammaFax board. It consists of more than 50 commands, allowing users to perform complex fax processing from DOS or other applications.

GammaNet displays graphics in Hercules, Genius, and Wyse-700 monochrome modes, as well as in all IBM graphics standards except 8514. Even without a graphics editor, *GammaNet* allows scaling and rotating of fax images. Workstations can-

not view a fax by invoking the TSR, however, but users must first exit to DOS and then run the fax-viewing utility.

GammaScript lets you send graphics to other fax machines and output them at 200 dots per inch.

As with other LAN fax packages, receiving faxes over the network is not quite as simple. GammaLink's *GammaMail*, a \$995 interface linking the GammaFax CP card to 3Com's *3+Mail*, cannot read the name of the recipient on an incoming fax. Thus, the administrator has to look at the cover page of each fax and then forward it to that person's LAN directory.

GammaScript runs in conjunction with the GammaFax CP card and converts PostScript-compatible files to fax format. This \$440 optional software package allows you to send graphics, CAD drawings, and DTP documents to other fax machines and output them at 200 dots per inch on a PostScript printer. *GammaScript* also supports



FACT FILE

GammaFax CP

GammaLink, 133 Caspian Ct., Sunnyvale, CA 94089; (408) 744-1430.

List Price: \$2,090. *GammaMail*, \$995; *GammaScript*, \$440.

Requires: A LAN using DOS 3.1 file- and record-locking calls, with a shared hard disk in a file server and one PC to act as the fax server. 250K RAM on fax server, 42K RAM on workstation.

In Short: GammaFax CP is a highly sophisticated fax server product. The package offers easy-to-follow menus, flexible user options, and a powerful command language at a competitive price. Don't let its less-than-streamlined installation procedure intimidate you.

CIRCLE 544 ON READER SERVICE CARD



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CIRCLE 495 ON READER SERVICE CARD



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E-MAIL PACKAGES WITH THE FAX TOUCH

by Kimberly Maxwell

Cluttering your network and workstations with separate TSR fax and e-mail software is undoubtedly not part of your LAN software agenda. As an alternative, several electronic mail packages are capable of sending fax transmissions in addition to standard e-mail messages. These enable you to mix fax and e-mail addressees on the same mailing list and let the software route the copies. Even better, if you already use *Cross+Point*, *Higgins*, or *Office Works* as the e-mail application on your local area network, then you're set to add LAN fax gateway capabilities.

These three packages aren't exactly peas in a pod; they vary greatly in both price and design. Cross Information Co.'s *Cross+Point* operates with a number of PC fax boards, including GammaFax CP, MicroFax, The Complete Fax, XAFax, JT Fax Board, and EZ-Fax. An unlimited number of users can share the package on a network for \$395. *Cross+Point* works on Novell and most NetBIOS-compatible networks, and it allows users to create and send fax messages without exiting the system's e-mail, bulletin board, or personal filing area.

Adding fax capabilities to Enable

Software's *Higgins* is no small task. You'll need to install several different software packages to get the *to:Fax* option to work.

First, choose between the *Higgins LAN Server Kit* (\$695), which combines e-mail with scheduling and database functions, and the *Higgins Mail Server Kit* (\$295), with e-mail functions only. Both programs are eight-user versions.

Next, you'll need to purchase *Higgins Exchange* (\$695), which routes the e-mail and invokes the fax server. *Exchange* serves up to ten file servers and unlimited workstations on a LAN.

Finally, in order for *Exchange* to have a fax capability to invoke, you'll need to install the \$995 *Higgins to:Fax* software package.

Once you're finished with this baroque installation process, the *Higgins* software is surprisingly easy to use. All faxing activity takes place in the background, leaving your computer free to return to other programs on the network. *Higgins* software works with Intel's Connection CoProcessor board and supports Novell and most NetBIOS-compatible networks.

The third fax-capable e-mail package is Data Access Corp.'s *Office*

Works, Version 2.0, which comes in several editions. The unlimited-user version sells for \$1,395, the six-user version is \$495, and the single-user version goes for \$195. The software supports Novell and NetBIOS networks and works only with the JT Fax Board. This group-productivity package sends but does not receive fax data. The software does notify the sender that data has arrived at the prerouted destination. ■

Cross+Point, Cross Information Co., 1881 Ninth St., Canyon Center #212, Boulder, CO 80302; (303) 444-7799.

List Price: \$395 (unlimited users).

CIRCLE 548 ON READER SERVICE CARD

Enable Software/Higgins Group, 1150 Marina Village Pkwy., #101, Alameda, CA 94501; (415) 865-9805. **List Price:** *Higgins LAN Server Kit* (eight users), \$695; *Higgins Mail Server Kit* (eight users), \$295; *Higgins Exchange*, \$695; *Higgins to:Fax*, \$995.

CIRCLE 549 ON READER SERVICE CARD

Office Works, Data Access Corp., 14000 SW 119th Ave., Miami, FL 33186; (305) 238-0012. **List Price:** Single-user version, \$195; six-user version, \$495; unlimited-user version, \$1,395.

CIRCLE 550 ON READER SERVICE CARD

HPGL and AutoCAD plotter-language files.

GammaLink's documentation and set-up may be too complex for some; only network managers should handle installation. But *GammaNet*'s well-designed menus and powerful command language make it suitable for almost any workgroup fax need.

INTERPRETER INC.

Facsimile Server

by C. G. Milligan

Interpreter doesn't kid around when it comes to producing a line of LAN fax gateway products. The \$3,900 Facsimile Server is a single-phone-line card-and-software package. A dual-phone-line ver-

sion is available for \$4,900, allowing one outgoing and one incoming line. And if you're shopping for a facsimile server at the same time you're looking for its fax card, Interpreter offers the same two options bundled with an AT-compatible computer for \$5,600 and \$7,695, respectively.

This machine must be used as a dedicated workstation for the Interpreter product. Each bundled package supports parallel and serial printers attached directly to the Facsimile Server in addition to those attached to the LAN.

The Interpreter card has DIP switches and jumpers for the configuration of address ports and interrupts. A 286-based PC with the full 640K base memory is recommended for the Facsimile Server if you elect not to purchase the bundled model. Software installation is automated, and configuration is entirely menu-driven. In

fact, the Interpreter's menu system is so well designed that the manual is almost unnecessary.



FACT FILE

Facsimile Server

Interpreter Inc., 11455 W. 48th Ave., Wheat Ridge, CO 80033; (303) 431-8991.

List Price: Card and software for single line, \$3,900; with AT-class computer, \$5,600. Dual-channel card and software with DID routing, \$4,900; with AT-class computer, \$7,695.

Requires: A LAN using DOS 3.1 file- and record-locking calls, with a shared hard disk in a file server and one PC to act as the fax server. 1MB RAM on fax server, 640K RAM on workstation. **In Short:** Interpreter's Facsimile Server comes separately or with its own 286-based dedicated workstation. Its *FServer* and *QuikFax* software include such features as image size scaling, file conversion, and simple menu operation.

CIRCLE 546 ON READER SERVICE CARD



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-Personal Computing's 10 Best Mail Order Companies, Feb. 1989



286 SYSTEMS FROM \$599

PCBRAND 286/12 _____ \$599

12 MHz Clock, Zero Wait Operation,
Norton SI 15.3 Landmark™ Speed 15.1MHz,
512K RAM, 1.2MB or 1.44MB Drive, 101-Key-board,
2 Serial and 1 Parallel Ports

PCBRAND 286/16 _____ \$749

16 MHz Clock, Zero Wait Operation,
Norton SI 19.0 Landmark™ Speed 20.6MHz,
512K RAM, 1.2MB or 1.44MB Drive, 101-Key-board,
2 Serial and 1 Parallel Ports

PCBRAND 286/20 _____ \$899

20 MHz Clock, Zero Wait Operation,
Norton SI 23.0 Landmark™ Speed 26.7MHz,
512K RAM, 1.2MB or 1.44MB Drive, 101-Key-board,
2 Serial and 1 Parallel Ports

Standard System Features:

- 80286-12, 80286-16, 80286-20 operating at 12 MHz, 16MHz, or 20MHz w/Zero Wait
- 512K RAM expandable to 8MB on the System board using 256K or 1MB 100ns RAM
- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
- FCC Class "A", Intended for business use
- High performance 16bit VGA Cards with 1024x768 capability on all VGA systems
- 1:1 Interleaved Hard/Floppy Drive Controller, 1Mb/Second disk transfer rates on all 100Mb drives or larger
- Enhanced 101-key Click/Tactile Keyboard
- 2 Serial & 1 Parallel ports on std-configurations
- High Capacity System Power supply
- Real Time Clock/Calendar with 5 Year Battery
- 80287 Co-Processor Support
- AMI BIOS w/full MS/DOS, OS/2, XENIX, UNIX, NOVELL, 3COM and PCNET compatibility
- Built-in System Board LIM 4.0EMS hardware
- User configurable I/O timing permitting compatible operation w/older peripherals or faster I/O for newer devices
- 8 Slot motherboard design (5 16Bit & 3 8Bit)
- Medium foot print case w/6 Disk Drive bays

Options:

- Low profile Slim Line Case w/3 Disk Bays available at no extra charge (pictured above)
- Mini Size desk top Tower Case w/4 bays
- LCD or Plasma Portable
- Factory Installed RAM Upgrades
- Custom configurations w/Name Brand peripherals of your choice

PC BRAND 286/12

w/512k, Hard Disk Drive, Monitor & Video Card

Hard Drives Mb/Ms	20/40	40/25	66/25	100/25
No Video	\$929	\$1029	\$1209	\$1349
Mono	\$1049	\$1149	\$1329	\$1469
VGA-Mono	\$1229	\$1329	\$1509	\$1649
VGA-Color	\$1459	\$1559	\$1739	\$1879
SVGA/Color	\$1569	\$1669	\$1849	\$1989

PC BRAND 286/16

w/512k, Hard Disk Drive, Monitor & Video Card

Hard Drives Mb/Ms	20/40	40/25	66/25	100/25
No Video	\$1079	\$1179	\$1359	\$1499
Mono	\$1199	\$1299	\$1479	\$1619
VGA-Mono	\$1379	\$1479	\$1659	\$1799
VGA-Color	\$1609	\$1709	\$1889	\$2029
SVGA/Color	\$1719	\$1819	\$1999	\$2139

PC BRAND 286/20

w/512k, Hard Disk Drive, Monitor & Video Card

Hard Drives Mb/Ms	20/40	40/25	66/25	100/25
No Video	\$1229	\$1329	\$1509	\$1649
Mono	\$1349	\$1449	\$1629	\$1769
VGA-Mono	\$1529	\$1629	\$1809	\$1949
VGA-Color	\$1759	\$1859	\$2039	\$2179
SVGA/Color	\$1869	\$1969	\$2149	\$2289

CIRCLE 303 ON READER SERVICE CARD



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MONEY BACK
GUARANTEE
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TOLL-FREE
SERVICE AND
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24 or 36 MONTH
LEASING
AND A 5-YEAR
WARRANTY**

**Best "Executive Decision"
System.**

**Personal Computing,
Best Bargain Systems,
Dec, 1989**

**"The PC Brand 386/SX-16
performed at least as well
as the far costlier Compaq...
We simply began marveling
at what is surely the big-
gest bargain in personal
computing"**

**Computer Buyer's Guide,
Cover Story, Oct, 1989**

Intel 386 Technology at 286 Prices the 386SX-16 Only \$899

PC BRAND 386/SX-16 \$899

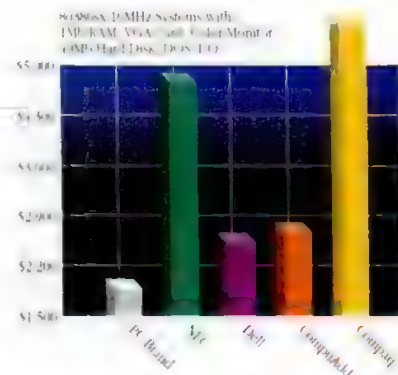
16 MHz Clock, Zero Wait Operation • Norton SI 18.7 Landmark™ 18.3MHz,
512K RAM, 1.2MB or 1.44MB Drive, 101-Key Keyboard, 2 Serial and 1 Parallel Ports

Standard System Features:

- 80386SX Processor Operating at 16MHz delivering 18MHz Effective Throughput
- 512K RAM expandable to 8MB on the System board using 256K and/or 1MB RAM
- 1 2MB 5.25" or 1.44MB 3.5" Diskette Drive
- FCC Class "A" Intended for business use
- High performance 16bit VGA Cards with 1024x768 capability on all VGA systems
- 11 Interleaved Hard Floppy Drive controllers, 1 Mb Second disk transfer rates on all 100-Mb drives or larger
- Enhanced 101-key Click Tactile Keyboard
- 2 Serial & 1 Parallel ports on std-configurations
- High Capacity 200 Watt System Power Supply
- Real Time Clock Calendar with 5 Year Battery
- 80387SX Co-Processor Support
- AMI BIOS with full MS-DOS, OS/2, XENIX, UNIX, NOVELL, SCOM compatibility
- 8 Slot motherboard design (5 16Bit & 3 8Bit)
- Medium foot print case w/ 6 Disk Drive bays (Shown in optional Mini Size Tower Case)

Options:

- Low profile Slim Line Case w/3 Disk Drive bays at no extra charge
- Mini Size desk top Tower Case w/ 4 Disk Drive bays (as pictured above)
- LCD or Plasma Portable
- Factory Installed RAM Upgrades
- Custom configurations w/ Name Brand peripherals of your choice



PC BRAND 386SX-16

w/512k, Hard Disk Drive, Monitor & Video Card

Hard Drives:	20/40	40/25	66/25	100/25
No Video	\$1,229	\$1,429	\$1,509	\$1,639
Mono	\$1,349	\$1,449	\$1,629	\$1,769
VGA Mono	\$1,529	\$1,629	\$1,809	\$1,949
VGA Color	\$1,759	\$1,859	\$2,039	\$2,179
SVGA Color	\$1,869	\$1,969	\$2,149	\$2,289

CIRCLE 308 ON READER SERVICE CARD

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PC BRAND'S
386/20
386/25...

"FASTER THAN
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BULLET!"

*Computer Shopper, Cover Story
November, 1988*

20MHz
FROM \$1349
25MHz
FROM \$1499

"The Best Low-Cost Alternative Around!"

-PC Magazine, 25MHz 386 PC's, Feb. 14, 1989

PC BRAND 386/20 ____ \$1349

20 MHz Clock, Zero Wait Operation,
Norton SI 23.0 Landmark Speed 26.1MHz,
1024K RAM, 1.2MB or 1.44MB Drive, 101-Key Board,
2 Serial and 1 Parallel Ports

PC BRAND 386/25 ____ \$1499

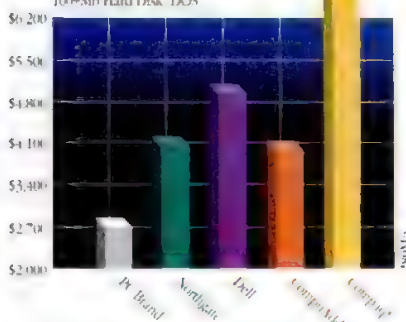
25 MHz Clock, Zero Wait Operation,
Norton SI 28.2 Landmark Speed 33.6MHz,
Norton SI 31.6 Landmark Speed 43.5 w/Cache,
1024K RAM, 1.2MB or 1.44MB Drive, 101-Key Board,
2 Serial and 1 Parallel Ports

"The PC Brand 386/25
is a fascinating machine.
It offers flexible configura-
tion...at a bargain price..."

"and the company backs
it all with what may be the
longest warranty on the
market...PC Brand makes
it possible to buy two com-
plete systems for less than
most competitors charge
for just one."

*- PC Magazine, 25MHz 386 PC's
February 14, 1989*

80386 20 MHz Systems with
2Mb RAM, VGA Card, Color Monitor,
100-Mb Hard Disk, DOS



Standard System Features:

- True 20MHz or 25MHzZ Intel 80386 CPU Operating with Zero Wait States
- 1024K RAM standard expandable to 16MB using 256K and/or 1MB RAM
- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
- FCC Class "A", Intended for business use
- High performance 16bit VGA Cards with 1024x768 capability on all VGA systems
- 1:1 Interleaving Hard Drive Floppy Drive controllers, 1Mb Second disk transfer rates on all 100Mb drives or larger
- Enhanced 101-key Click/Tactile Keyboard
- 2 serial & 1 parallel ports on std configurations
- High Capacity 200Watt System Power Supply
- Real Time Clock/Calendar with 5 Year Battery
- 80287, 80387, or Weitek Co-Processor Support
- AMI BIOS with full MS-DOS, OS/2, XENIX, UNIX, NOVELL, 3COM compatibility
- 8 Slot motherboard design (5 16Bit & 3 8Bit)
- Medium foot print case w/6 Disk Drive bays

Options:

- Low profile Slim-Line Case w/3 Disk Drive bays available at no extra charge
- Full Size Tower Case w/6 Disk Drive bays
- Mini Size Tower Case w/4 Disk Drive bays
- LCD or VGA Plasma Portable Case
- Custom configurations w/ Name Brand peripherals of your choice

PC BRAND 386/20

with Hard Disk Drive, Monitor & Video Card

Hard Drives: Mb Mb	40/25	66/25	100/25	200/19
No Video	\$1779	\$1959	\$2099	\$2549
Mono	\$1899	\$2079	\$2219	\$2669
VGA-Mono	\$2079	\$2259	\$2399	\$2849
VGA-Color	\$2409	\$2489	\$2629	\$3079
SVGA/Color	\$2419	\$2599	\$2749	\$3189

PC BRAND 386/25

with Hard Disk Drive, Monitor & Video Card

Hard Drives: Mb Mb	40/25	66/25	100/25	200/19
No Video	\$1929	\$2109	\$2249	\$2699
Mono	\$2049	\$2229	\$2369	\$2819
VGA-Mono	\$2229	\$2409	\$2549	\$2999
VGA-Color	\$2459	\$2639	\$2779	\$3229
SVGA-Color	\$2509	\$2719	\$2889	\$3439

CIRCLE 309 ON READER SERVICE CARD



"PC BRAND 386/33 HAS FLAWLESS COMPATIBILITY, LOWEST PRICE"

*InfoWorld, Product Review,
January 8, 1990*

FROM \$2299

InfoWorld 386/33 Review Scores:



PC Brand _____ 8.0
Compaq _____ 7.1
Gateway 2000 _____ 7.1

386/33 CACHE _____ \$2299

33 MHz Clock, Zero Wait Operation,
Norton SI 45.9 • Landmark 58.7 MHz,
1024K RAM, 1.2MB or 1.44MB Drive, 101-Key-board,
2 Serial and 1 Parallel Ports

"Here's a price \$2799...
[Now \$2299] Must be
stripped to nothing, Right?
Wrong..You don't sacrifice
quality for low price either.
The PC Brand machines
are an efficient combi-
nation of in-house en-
gineering and top-notch
off-the-shelf Parts."

*-PC Magazine, 33MHz 386 PC's,
October 31, 1989*

"...great value. Period.
...excellent price perform-
ance ratio; high quality."

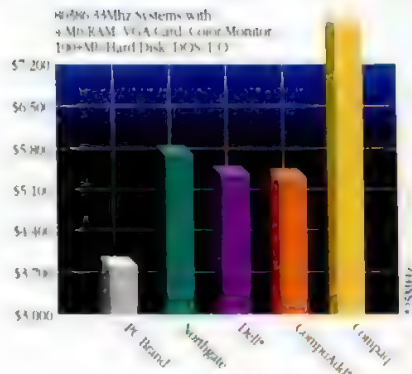
*-Computer Buyers Guide,
Product Review,
February, 1990*

Standard System Features:

- True 33 MHz INTEL 80386-33 CPU operating w/ Zero Wait States Delivering up to 58.7 MHz Effective Throughput
- Intel 82385-33 Cache Processor with 32K 25NS Static RAM Standard
- 1024K RAM Standard Expandable to 16MB
- FCC Class "A", Intended for business use
- High performance 16bit VGA Cards with 1024x768 capability on all VGA systems
- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
- 1:1 Interleaving Hard Drive/Floppy Drive Controllers, 1 Mb Second disk transfer rates on all 100Mb drives or larger
- Enhanced 101-key Click Tactile Keyboard
- I/O Ports-2 serial, 1 parallel
- High Capacity 200 Watt System Power Supply
- Real Time Clock/Calendar with 5 Year Battery
- 80387 or Weitek Co-Processor support
- Phoenix BIOS with Full MS-DOS, OS/2, XENIX, UNIX, NOVELL, 3COM compatibility
- EMS and Disk Cache in ROM
- 8 Slot motherboard design
- Medium foot print case w/ 6 Disk Drive bays

Options:

- Full size Tower Case w/6 Disk Drive bays (as shown above)
- Custom configurations w/Name Brand peripherals of your choice
- Factory Ram Upgrades



PC BRAND 386/33 CACHE

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Hard Drives:	40/25	66/25	100/25	200/19
No Video	\$2679	\$2859	\$2999	\$3449
Mono	\$2799	\$2979	\$3119	\$3569
VGA Mono	\$2979	\$3159	\$3299	\$3749
VGA-Color	\$3209	\$3389	\$3529	\$3979
SVGA/Color	\$3319	\$3499	\$3639	\$4089

Turn the page for Portables & Peripherals

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3D 14" SVGA/EGA (1024x768)	649
4D 16" SVGA/EGA (1024x768)	1150
5D 20" SVGA/EGA (1280x1024)	2350
Cornerstone Technology	
19" Dualpage Display (1600x1200)	\$1950
19" Dualpage 16 level (1600x1200)	2795
Imtek/Samsung	
14" VGA Color .31DP (640x480)	\$369
14" VGA Color .61DP (640x480)	299
14" SVGA Color (w/ 1024x768)	419
Magnovox	
Newest Models	Call
Mitsubishi	
1381 14" Diamond Scan (w/ 800x600)	\$499
HL6605 16" SVGA/EGA (w/ 1280x1024)	1195
HL6905 20" SVGA/EGA (w/ 1280x1024)	2095
Panasonic	
C1591 Panafsync (w/ 800x600)	\$489
M1500 15" Mono DTP w/ adapter	1206
M1500 19" Mono DTP w/ adapter	1496
Princeton Graphics	
Max15 14" Mono (w/ 1024x768)	\$249
UltraSync 14" SVGA/EGA (800x600)	520
UltraSync 16" SVGA/EGA (1024x768)	879
Princeton Publishing Labs	
MultiView 15" Mono DTP w/ adapter	\$690
Reliays	
9503 14" VGA Mono (640x480)	\$135
9513 14" VGA Color (640x480)	369
1520 15" SVGA (1024x768)	679
Saiko	
1440 14" SVGA (1024x768)	\$599
1450 14" SVGA (1024x768)	779
Sony	
1304 14" SVGA (w/ 1024x768)	\$689
GDM-1606 16" CADD (1280x1024)	Call
GDM-1953 19" CADD (1280x1024)	Call
Zanith	
ZCM1492 VGA Flatcreen (640x480)	\$619

Video Cards

ATI	
VGA Wonder 256K/512K	\$299/339
VGA Wonder V-RAM	Call
NEC	
Graphics Engine (1024x768) 512K/1M	\$999/1349
Paradise	
EGA Adapter with 4MB	\$139
VGA+ w/ 256K (8 bit)	219
VGA+ w/ 256K (16 bit)	249
VGA Professional	349
VGA 1024 w/ 512K	239
8514/A Plus	569
8514/A Plus w/ VGA	649

PC BRAND VGA Cards

VGA 256K (8 bit) \$99
VGA 256K (16 bit) 139
VGA 512K (16 bit) 189

"an outstanding device... compared with the 15 high performance VGA cards tested in PC Magazine's July 1989 issue."

-PC Magazine,
Product Review,
Oct. 31, 1989

Video Seven

1024i VGA with 256K	\$259
VRAM VGA with 512K	493

Modems

ATI	
2400ETC Internal with MNP5	\$165
2400ETC External with MNP5	205
Hayes	
1200B Internal with Smartcom	\$189
2400B Internal with Smartcom	249
1200 External	256
2400 External	359
PC Brand (100% Hayes Compatible)	
1200 Internal with software	\$49
1200 External	70
2400 Internal with software	89
2400 External	129
2400 Internal with MNP5	129
US Robotics	
Courier HST 14,400 External	\$599
Courier V.32 9600 External	889
Courier HST/V.32 External	995
Courier HST 9600 Internal	579

Fax Cards

Complete PC	
4800/9600	\$249/399
Complete Communicator	549
Intel	
Connection Coprocessor	\$699
Quadram	
4800/9600	\$199/509

Co-Processors

Intel	
8087-1	\$189
8087-10	229
80387-16	349
8087-2	\$129
80387-SX	309
80387-20	399

Floppy Disk Drives

360K 5.25" Half Height Black	\$75
720K 5.25" Half Height Black	80
1.2M 5.25" Half Height Grey	85
1.44M 3.5" Half Height Grey	95
CMS 5.25" 360K PS-2 Internal	199
Sygen	
Bridge-File 5.25" 360K/1.2MB External	\$329
Bridge-File 3.5" 720K/1.44MB External	229
Bridge-File PC/AT Adapter	59

Hard Disk Drives

Compaq/Conner IDE Upgrades	
40M 28ms	\$459
100M 21ms	\$679
200M 19ms	1249
Imaging	
B1201 20M Int.	\$765
B1441 40M Int.	\$995
B244X Dual 5.25 44M External	1995
PC2/50 Nonbootable Card	230
PC2B/50 Bootable Card	230
Plus Hardcards	
Hardcard 20 8 bit	\$539
Hardcard 40 8 bit or 16 bit	599
Hardcard 80 16 bit	695
Seagate	
20M 65ms ST225 Half Height	\$209
20M 35ms ST125 Half Height	245
30M 35ms ST130 Half Height	310
40M 28ms ST251-1 Half Height	349
40M 24ms ST251 Half Height	419
80M 28ms ST4095 MFM	590

Add \$50 for XT Kit for ST1xx, ST2xx

Tape Backups

Archive	
ST500 60MB Internal with controller	\$590
FT60 60MB External with controller	590
FT150 150MB Internal with controller	895
VP150 150MB Internal Novell certified	925
VP150E 150MB External Novell certified	1175
VP402 Interface Board for VP Series	Call
VP409 PS/2 Interface Board for VP Series	Call
Colorado Memory Systems	
DJ-10 Jumbo 40/80MB Internal	\$249
KE-10 External Chassis Kit with Interface	139
Maynard	
Maystream 60MB Portable	\$889
Maystream 150MB Portable	1395
Maystream 2300BIS 2.2GB Portable	4350

RAM/I-O/Accelerator Boards

Intel	
Aboveboard Plus 512K	\$419
Aboveboard Plus I/O	469
Inboard 386 PC w/1M	595
Inboard 386 AT w/0K	859
PC Brand I/O Cards	
AT 1P/2S/1G	\$49
XT 1P/1S/1G/Clock/Calendar	49

CD-ROM

Amdak	
Laserdeck 2000 500MB External Kit	\$619
Microsoft	
Bookshelf 1.0	\$195
Stat Pack	999
Programmer's Library	295
NEC	
CDR77 Ext.	\$555
CDR80 Int.	\$499
XT/AT Interface Kit	139
Clipart 3D	285
Image Folio	285
Sony	
CDU510 Internal Kit	\$665
CDU1701 External Kit	779

Plotters

CalComp	
1025	\$3450
1043DM	\$5700
Houston Instruments (Call for Prices)	
DMP52	DMP52MP
DMP61	DMP61DL
DMP62	DMP62DL

Scanners/Digitizers

Complete PC	
Full Page Scanner	\$499
Half Page Scanner	189
Hand Scanner	165
Kurfs	
IS/One 12X12	\$355
IS/One 12X17	\$509
Microtek	
MSF 300G	\$1495
MSF 300Q	1275
MSF 400G	2750
MSH Edge Feed	1050
Summagraphics II Digitizers	
12x12	\$335
12x18	\$599

Input Devices

CalComp WIZ 1000 DPI	
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Hi-Res C9 Mouse	605
with Palm	999
Trackman 320 DPI Serial/Bus	99/199
Microsoft Mice	
Serial with Palmbrush 200 DPI	\$109
Serial with Windows 200 DPI	139
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Power Protection Products

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SK6 Splitter Bar	\$29
EB4 4 Outlet Isobar	45
CCI+ Isobar	85
LC1200 Line Cond.	159
BC325 Battery Back-up	279
BC450 Battery Back-up	349
OMNI450 or 450LAN Battery Back-up	419
BC750LAN Battery Back-up	459
OMNI1200 Battery Back-up	795

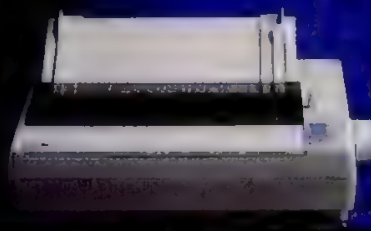
CIRCLE 310 ON READER SERVICE CARD



102 Key Keyboard **\$95**
(Virtually identical to Northgate Omnkey)



Epson LQ 510 **\$329**



Printers

(Numbers in Parentheses Indicate Draft/LQ CPS)

Brother	
HL6c Laser	\$1875
HL6P8 BPPM	3295
Canon	
IJ130c 15"	\$769
LBP4 Laser BPPM	1725
Citizen	
G8X 140 (192)	\$339
Color Kit	49
Epson	
LX810 (180/30)	\$179
FX1050 (360/94)	479
LQ850 (330/80)	495
LQ1010 (190/30)	439
LQ2550 (400/100)	899
Hewlett Packard	
Deskjet Plus	\$710
Laserjet II	1720
Laserjet III NEW!	Call

Laser Jet Accessories

Pacific Data Products	
Plotter in Cartridge	\$249
25 in 1 Cart.	285
Postscript Cartridge	449

Turn your Laserjet into a Postscript Printer!

CPI	
Superfont Cart.	\$295
1M Memory Kit	269
2M Memory Kit	549
Princeton Publishing	
PS-384 Postscript board	\$2250

Call about 400dpi Postscript Compatible Laser Printers

Kodak Diconix	
150P/80 (150/90)	\$315
300WP (310/73)	439
NEC	
P2200XL (192/94)	\$335
P5XL (400/190)	1030
LC890 BPPM Postscript	3190
LC890XL BPPM 4MB	4495
Okidata	
ML320 (360/43)	\$345
ML321 (360/62)	479
ML380 (180/60)	359
ML390 (270/90)	475
ML391 (270/90)	655
ML393 (450/120)	995
Okidata Okilaser 400 4PPM	1010
Panasonic	
1180 (192/30)	\$189
1124 (190/60)	299
1624 (192/63)	429
1695 (330 wide)	Call
4420 Laser	
Call	
Logical Connection	
256K/512K Print Buffer	\$449/529

*Oversized Monitors, Plotters, Laser Printers, and Portables excluded from Free Freight!

Networking Hardware

Gateway	
G/Ethernet AT	\$435
for PS/2	\$435
G/Ethernet (8 bit)	265
Lantronic	
Call for Prices	
Standard Micro	
PS110 Board for PS/2	\$439
PC500WS 16 Bit for WS	375
PC500FS 16 Bit for Server	449
PC550WS 16 Bit Twisted Pair for WS	395
PC550FS 16 Bit Twisted Pair for Server	495
PC270E Twisted Pair	139
PC130 Arcnet Board	135
ARCNET passive hubs / active hubs	72/359
ARCNET Intelligent hub coax	495
ARCNET Intelligent hub twisted pair	609
Synopsis	
MSUTP Transceiver	\$139
1000 Concentrator	2575
2500 Workgroup Concentrator	839
3Com	
Call for Latest Prices	
Tiara	
4 port hubs	\$49
8 port hubs	\$285
Lancard/A 8 bit ARCNET	89
Lancard/A 16 bit ARCNET Board	249
Lancard/E 8 bit Ethernet	199
Lancard/E 16 bit Ethernet Twisted Pair	339
Lancard/E 8 bit Twisted Pair	329
Tops	
Repeater	\$125
Flashcard	\$155
Western Digital	
Ethercard+	\$219
A (PS/2)	\$320
Ethercard+ Twisted Pair	319
Xircor	
Pocket ARCNET Adapter Coax or Tw. Pr.	\$295
Pocket Ethernet Adapter Twisted Pair	489

Supplies

Sony 5.25" 360K (box)	\$9
Sony 5.25" 1.2M (box)	14
Sony 3.5" 720K (box)	13
Sony 3.5" 1.44M (box)	25
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3.5" Diskette Case	11
Toner Cartridge for HP Deskjet Plus,	
Laserjet II and IIP	
Call	
Data Cartridges	
DC2000 (ea.)	\$19
DC600 (ea.)	\$27
DC600XL (ench)	29

Novell Networking

4 User ELS Level I	\$429
8 User ELS Level II	939
Advanced Network	1850
SFT Network 286	2850
Network 386	4550

Network Utilities

CC: Mail	
25 User	\$495
Expand	\$445
Cheyenne Software	
Netback	\$189
Monitrox	\$505
Lan Systems	
Lanspace	\$310
Lanspool	\$259
Norton-Lambert	
Close-up Support/ACS	\$179
Close-up Customer/Terminal	135
Ontrack	
Disk Manager - N	\$99
Netutils	Call
Tops	
NetPrint 2.0	\$115
Tops 2.1	\$112
Traveling Software	
Desklink 2.2	\$95
Laplink III	\$92

Unix/Xenix Multiuser Products

Digiboard	
Intelligent Serial Cards:	
4/8/16 Port	\$645/795/1295
Wyse Terminals	
WY60	\$309
WY150	305
WY370 14" Color	Call
(Call for Keyboard options)	
WY50 (with Keyboard)	389
WY85 (with Keyboard)	409
Santa Cruz Operations	
Xenix 286 Complete Sys	\$995
Xenix 386 Complete Sys	1150
Xenix Software	
Foxbase+ 386	\$979
Microsoft Word	495
Open Deskjet	Call
VP/IX 1/3+ User	\$59/629
Xenix-Net 286/386	439/479
Word Perfect 4.2	569

*Free Freight in the Continental U.S.

Software

Aldus Pagemaker	\$499
AMI for Windows	129
Professional	319
Autosketch Animator	179
dbase IV	449
Borland Quattro	95
Quattro Pro	279
Caere Omnipage 386 2.1	619
Corel Draw	339
Datatum ProComm Plus	52
Dejima Perform 2.0	159
Delta Technology Direct Access	49
Deskview 386	115
Fifth Generation Fastback Plus	102
Foxbase +	189
Generic CADD Level 3	155
Harvard Graphics	329
IBM Displaywrite IV	249
Lotus Freelance Plus	329
Lotus 123 r. 2.2	339
Lotus 123 r. 3.0	339
Microsoft Excel 2.1	309
Microsoft Works	99
Microsoft Windows 386	125
Microsoft Word 5.0	205
for Windows	325
Northridge Timeslips III	159
Norton Utilities Adv.	79
Paradox v. 3.0	Call
PC Tools 5.5	79
Peachtree Acctg III	149
Peachtree Complete III w/ Data Query	225
Professional Write	145
Quicken	39
Symatec Q&A 3.0	215
Timeline 3.0	379
Timeworks Publish II	125
Word Perfect 5.1	249
Wordstar Pro 5.5	235
Ventura Publisher 2.0	499

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CIRCLE 311 ON READER SERVICE CARD

Portables with More Power than Desktops.

CGA/Monographic Gas Plasmas from _____ **\$1745**
VGA Gas Plasmas from _____ **\$2595**

512K (286,386/sx) or 1024K (386)
RAM, Serial and Parallel Ports
1.2MB or 1.44MB Floppy, 86-Keyboards

The power, reliability and performance of our desktop system motherboards combine with our portable casing to make our systems technically unique!

We support 3 built-in, externally accessible disk drives, enabling dual (3.5" and 5.25") floppies for *total* media compatibility. Including tape, CD-ROM drives or other devices to deliver desktop functionality in a Portable Unit.

Simultaneous internal AND external monitor support, VGA functionality, 2 open card slots and our unique 3 drive support, permit this family to be used as a complete "in the office system" which you can pick up and take anywhere.

Standard System Features:

- All performance and compatibility features as in desktop models featured on previous pages
- 3 Accessible Drive Bays for 2 5.25" & 1 3.5" Units
- 2 Available Peripheral Card Slots
- 16 Grey Scale 640x480 VGA or 4 Grey Scale 640x400 CGA Mono Graphics Plasma Display
- Simultaneous internal and external displays
- 200Watt Auto Voltage Switching Power Supply



*Actual VGA PLASMA Screen Image
16 grey scale display operates
concurrently in all VGA modes
with external monitor*

VGA Gas Plasma Portables

Drives	1 Floppy	40Mb-25Mb	100Mb-25Mb	200Mb-10Mb
286/12	\$2595	\$2895	\$3395	\$3895
286/20	\$2795	\$3195	\$3595	\$4095
386/SX-16	\$2895	\$3295	\$3695	\$4195
386/20	\$3350	\$3750	\$4150	\$4710
386/25	\$3550	\$3950	\$4350	\$4910
386C/25*	\$4000	\$4400	\$4800	\$5300
386C/33*	\$4500	\$4900	\$5300	\$5800

*32K cached versions

CGA/MGA Gas Plasma Portables

Drives	1 Floppy	40Mb-25Mb	100Mb-25Mb	200Mb-10Mb
286/12	\$1745	\$2145	\$2545	\$3110
286/20	\$1945	\$2345	\$2745	\$3310
386/SX-16	\$2045	\$2445	\$2845	\$3410
386/20	\$2395	\$2795	\$3195	\$3855
386/25	\$2595	\$2995	\$3395	\$4055
386C/25*	\$3145	\$3545	\$3945	\$4505
386C/33*	\$3645	\$4045	\$4445	\$5005

*32K cached versions

"THE VGA
PORTABLE III
IS EXTREMELY
FLEXIBLE..."

...more drive capacity
than most...and the
bang-for-the-buck
ratio is very high...
excellent high powered
performance."

*PC Magazine,
Over 20 pounds,
over 20Mhz portables,
December 12, 1989*

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CONNECTIVITY

LAN FAX GATEWAYS

Facsimile Server's bundled *FServer* software provides an intuitive menu system for file selection, phone-list editing, file conversion, and queuing for transmission. Faxes are stored on the dedicated LAN file server, and the Facsimile Server polls the file server for queued jobs. *FServer* enables you to convert files for a WYSIWYG preview of each fax prior to its transmission.

In addition to date-and-time transmission scheduling, you can assign up to nine priority scheduling levels for delayed transmission. *FServer* also notifies you of the queue's status and the completion of transmissions.

QuikFax, a TSR pop-up fax menu included with the package, allows you to transmit a fax from a standard application, provided the application is set up to operate an Epson printer on LPT1. The version of the *QuikFax* TSR we tested requires 30K of workstation RAM, but Interpreter claims it is rewriting this utility to reduce the memory requirement to 15K RAM and to include the Hewlett-Packard Printer Control Language.

FServer and *QuikFax* provide distribution-list calling capabilities, with no limit on the quantity of phone numbers you can include in the software's listings. Another important feature is the system's ability to convert files from *PC Paintbrush* image format to fax format and back again. This allows you to receive a fax and modify it with *PC Paintbrush* or import it to a desktop publisher.

Interpreter's software allows you to at-

tach optional cover sheets, letterheads, and signature files to faxes. Add to this such features as fax-viewing functions, image size scaling, and file conversion, and the Facsimile Server is a system worth serious consideration.

OAZ COMMUNICATIONS INC.

NetFAX

by Kimberly Maxwell

If you are a committed user of Message Handling Service (MHS) on a *NetWare* LAN, then OAZ Communications' *NetFAX* is probably the fax server gateway product for you.

The *NetFAX* package includes a communications coprocessor board and the *NetFax Manager* server and user software packages. *NetFAX* works on both Novell and NetBIOS networks, for \$2,090 and \$1,495, respectively. The board has a built-in scanner interface, and OAZ offers options for scanner capabilities and for converting OCR images to text. If you have some serious fax volume, OAZ has special pricing for additional fax servers on the same LAN.

The Novell version runs as a dedicated fax server and uses MHS as a link between existing e-mail applications on your network and the *NetFax Manager*. You can configure your *NetFAX* system to avoid

using MHS if you prefer not to rely on this service to act as the traffic cop for your fax.

If your *NetWare* LAN already has an MHS-compatible e-mail system, *NetFAX* will move messages between MHS and the fax board. If your e-mail system doesn't use MHS, you can create messages with a special text string containing delivery directions for *NetFAX* and save them in a special subdirectory that is periodically scanned by *NetFax Manager*. Another useful *NetFAX* option allows anyone on the network to fax a document from any software that prints documents to an HP LaserJet printer.

The NetBIOS version of *NetFAX* does not tie into e-mail applications and does not require MHS. The software runs in the background on any network workstation and is compatible with operating systems



FACT FILE

NetFAX

OAZ Communications Inc., 1362 Bordeaux, Sunnyvale, CA 94089; (408) 745-1750.

List Price: \$2,090 (Novell version), \$1,495 (NetBIOS version).

Requires: A LAN using DOS 3.1 file- and record-locking calls, with a shared hard disk in a file server and one PC to act as the fax server. 512K RAM on fax server, 14K RAM on workstation.

In Short: OAZ Communications' *NetWare*-compatible *NetFAX* employs an MHS interface that allows you to use an existing e-mail application on your network. Installation complexity and I/O address inflexibility mar an otherwise excellent performer.

CIRCLE 546 ON READER SERVICE CARD

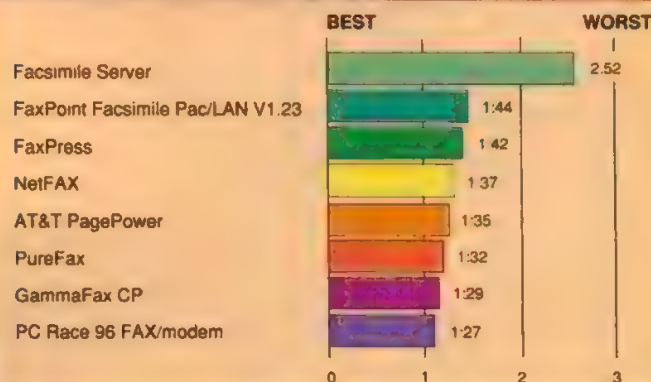


PERFORMANCE TESTS: LAN FAX GATEWAYS

Workers on network stations do not experience any delay when they send their faxes to a LAN fax server, so these LAN fax products offer little to test. The fax servers do, however, use different file translation schemes and software architectures that have an effect on telephone connection times. Since some carriers bill for long-distance phone calls in 6-second intervals, small differences in line-holding time can create significant differences in cost when multiplied by many calls.

For each product, we measured the amount of time the phone has to be "off the hook" in transferring a 1.5-page image from the fax server to a standalone Sharp fax machine over local phone lines. The reported result represents an average time for repeated calls. Only Interpreter's Facsimile Server system lags behind the others—which operate within mere seconds of each other, with the PC Race 96 FAX/modem and GammaFax CP in the lead. Such small differences may not seem worth noting when you're deciding which product to buy, but they can make a big difference in your monthly phone bill.

OFF-HOOK TIME (minutes and seconds)



Savings you can't 28 systems



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The CompuAdd 810

Affordable enough for student use. Powerful enough for the home office. The CompuAdd 810 is a highly cost-efficient entry-level system. **\$595** 64710

- NEC V20 processor rated at 10MHz
- 640KB RAM with parity checking
- Built-in dual hard drive interface
- Built-in dual diskette drive controller
- Built-in parallel port and two serial ports
- Three full-size and two half-size expansion slots
- Built-in game port interface (requires cable, 48954)
- 8087 math coprocessor socket
- 5.25" 360KB diskette drive
- Real-time clock
- 101-key enhanced keyboard

CompuAdd 810 Monitor And Hard Drive Options

	MGA	CGA	CVGA
No Hard Drive	64701 — \$690	64706 — \$830	64711 — \$1050
20MB (69ms)	64702 — \$970	64707 — \$1110	64712 — \$1330
40MB (69ms)	64703 — \$1120	64708 — \$1260	64713 — \$1480

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These low profile machines save money and desk space without sacrificing power and performance. Built-in functions reduce by two the number of expansion cards users typically purchase. The result to you: increased functionality and reliability in a smaller package.

The CompuAdd 212

Far and away the best value on the market today in a 286 AT machine. Running at 12.5MHz, it can handle the toughest MS-DOS-based software. **\$895** 64730

- 80286 processor running at 12.5MHz
- 512KB RAM expandable to 4MB on motherboard
- 0 wait state page-mode memory
- Built-in dual hard drive interface
- Built-in dual diskette drive controller
- Built-in parallel port and two serial ports

- Built-in game port interface (requires cable, 48954)
- Three full-size 16-bit and two half-size 8-bit expansion slots
- 80287 math coprocessor socket
- Choice of 5.25" 1.2MB or 3.5" 1.44MB diskette drive
- 101-key enhanced keyboard
- Monitor optional.

The CompuAdd 316s

If you thought you couldn't afford a 386, the 316s could change your mind. Power-packed on a small footprint, the 316s opens the door to 386 software at an exceptionally low price. Like all 386 machines, the 316s comes with one year of FREE onsite service. **\$1295** 64787

- 386SX processor running at 16MHz
- 1MB memory expandable to 4MB on motherboard
- 0 wait state page-mode memory
- Built-in dual hard drive interface
- Built-in dual diskette drive controller
- Built-in parallel port and two serial ports
- Built-in game port interface (requires cable, 48954)
- Three full-size 16-bit and two half-size 8-bit expansion slots
- 387SX math coprocessor socket
- Choice of 5.25" 1.2MB or 3.5" 1.44MB diskette drive
- 101-key enhanced keyboard
- Monitor optional.

CompuAdd 212 Monitor And Hard Drive Options

	MGA	EGA	CVGA
20MB (28ms)	64731 — \$1359	64736 — \$1709	64741 — \$1719
40MB (28ms)	64732 — \$1499	64737 — \$1849	64742 — \$1859
80MB (19ms)	64733 — \$1729	64738 — \$2079	64743 — \$2089

CompuAdd 316s Monitor And Hard Drive Options

	MGA	MVGA	CVGA
40MB (28ms)	64788 — \$1899	64791 — \$2009	64793 — \$2259
80MB (19ms)	64789 — \$2129	64792 — \$2239	64794 — \$2489
110MB (19ms)	64790 — \$2329	64796 — \$2439	64795 — \$2689

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Powerhouses

Save time with speed systems that respond quickly to your every request. High performance combined with cutting edge technology and SCO™ XENIX®, UNIX®, OS/2 and MS-DOS compatibility make these PCs totally capable.

The CompuAdd 316

"The CompuAdd (316) is a good example of the kind of value you can get for **\$2569** by mail."

64812

PC Magazine, February, 1989

- 386 processor running at 16MHz
- 0 wait state page-mode memory
- 1MB RAM expandable to 10MB
- Disk caching software
- LIM 4.0 support
- Dual diskette controller with dual hard drive interface
- Built-in parallel port and two serial ports
- Five available expansion slots
- Choice of 5.25" 1.2MB or 3.5" 1.44MB diskette drive
- 40MB hard drive

- Monochrome VGA monitor
- 16-bit VGA video adapter card
- 101-key enhanced keyboard
- New Spinnaker® Eight-in-One™ integrated software
- **Free one-year onsite service**

Color monitor optional.



The CompuAdd 325

"Each (386) system comes packed with features—and at prices that won't empty your savings account."

\$3799

64836

PC Magazine, May 30, 1989

- 386 processor running at 25MHz
- High-speed cache memory controller with 32KB of static RAM cache
- 1MB fully available RAM expandable to 16MB
- Disk caching software
- LIM 4.0 support
- ROM shadowing into faster DRAM
- Dual diskette controller with dual hard drive interface
- Built-in parallel port and two serial ports
- Five available expansion slots
- 387 math coprocessor socket
- Choice of 5.25" 1.2MB or 3.5" 1.44MB diskette drive
- 40MB hard drive
- Monochrome VGA monitor
- 16-bit VGA video adapter card
- 101-key enhanced keyboard
- New Spinnaker Eight-in-One integrated software
- **Free one-year onsite service**

Color monitor optional.

CompuAdd 316 Monitor And Hard Drive Options

	MVGA	CVGA
40MB (28ms)	64812 — \$2569	64817 — \$2799
80MB (19ms)	64813 — \$2799	64818 — \$2999
110MB (19ms)	64814 — \$2999	64819 — \$3299
150MB (18ms)	64815 — \$3299	64820 — \$3599

CompuAdd 325 Monitor And Hard Drive Options

	MVGA	CVGA
40MB (28ms)	64836 — \$3799	64842 — \$4099
80MB (19ms)	64837 — \$4099	64843 — \$4399
110MB (19ms)	64838 — \$4299	64844 — \$4599
320MB (18ms)	64839 — \$5209	64845 — \$5499

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Every hardware product and every off or accessory CompuAdd sells will give complete satisfaction. If not, return it in the original packaging, freight and insurance prepaid. Within 30 days of purchase for a full refund of the purchase price. No questions asked. Software, videotapes, and shipping costs not refundable.

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The Career Starter Kit

For **\$899** You Get:

64716

- CompuAdd 810 computer (XT-compatible)
- NEC V20 processor rated at 10MHz
- 640KB RAM with parity checking
- Built-in dual hard drive interface
- Built-in dual diskette drive controller
- Built-in parallel printer port and two serial ports
- Built-in game port interface (requires cable, 48954)
- Three full-size and two half-size XT class expansion slots
- 8087 math coprocessor socket
- 5.25" 360KB diskette drive
- Monographics monitor and adapter
- Star* Micronics NX-1000™ printer and cable
- CompuAdd MS-DOS v4.01 and GW-BASIC* software
- New Spinnaker Eight-in-One integrated software
- 101-key enhanced keyboard
- Computer paper and ten blank diskettes

Color monitor optional.

The Professional Starter Kit

Computerize Your Business For **\$1495**

64747

- CompuAdd 212 computer (AT-compatible)
- 80286 processor running at 12.5MHz
- 512KB RAM expandable to 4MB on motherboard
- 0 wait state page-mode memory
- Built-in dual hard drive interface
- Built-in dual diskette drive controller
- Built-in parallel printer port and two serial ports
- Built-in game port interface (requires cable, 48954)
- Three full-size 16-bit and two half-size 8-bit AT class expansion slots
- 80287 math coprocessor socket
- Choice of 5.25" 1.2MB or 3.5" 1.44MB diskette drive
- 40MB hard drive
- Monographics monitor and adapter
- Panasonic* 1180 printer and cable
- CompuAdd MS-DOS v4.01 and GW-BASIC* software
- New Spinnaker Eight-in-One integrated software
- 101-key enhanced keyboard
- Computer paper and ten blank diskettes

Color monitor optional.

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In a market full of complicated, costly alternatives, the CompuAdd SX Success Kit offers you a complete, smart 386SX system solution that will carry you through the '90s.

All For Only **\$1895**

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- 386SX processor running at 16MHz
- 1MB expandable to 4MB on the motherboard
- 0 wait state page-mode memory
- Disk caching, ROM shadowing and LIM 4.0 EMS support in ROM
- Built-in dual hard drive interface
- Built-in dual diskette drive controller
- Built-in parallel printer port and two serial ports
- Built-in game port interface (requires cable, 48954)
- Three 16-bit and two 8-bit expansion slots
- 387SX math coprocessor socket
- Choice of 5.25" 1.2MB or 3.5" 1.44MB diskette drive
- 40MB hard drive
- Monographics monitor and graphics adapter card
- Panasonic 1180 printer and cable
- CompuAdd mouse and Paintshow Plus™ software
- 101-key enhanced keyboard
- Computer paper, ten blank diskettes and a Smart Start Kit full of software demos and special offers

Color monitor optional.

Career Starter Kit Monitor And Hard Drive Options

	MGA	CGA	CVGA
No Hard Drive	64716 — \$899	64721 — \$1039	64726 — \$1259
20MB (69ms)	64717 — \$1179	64722 — \$1319	64727 — \$1539
40MB (69ms)	64718 — \$1329	64723 — \$1469	64728 — \$1689

Professional Starter Kit Monitor And Hard Drive Options

	MGA	EGA	CVGA
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80MB (19ms)	64748 — \$1905	64753 — \$2255	64758 — \$2265

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CONNECTIVITY

LAN FAX GATEWAYS

from 3Com, Banyan, IBM, and several other companies that provide NetBIOS services.

The great drawback to the NetFAX system is that the hardware and software installation process is both complex and poorly documented. The adapter board has only one I/O address, making it necessary to configure the rest of your network adapters and any other I/O cards in your fax server around the fax board.

Graphics formats compatible with NetFAX (using *HiJaak*, from Inset Systems) are .PCX, .TIF, .IMG, and those produced by Dr. Halo, *Microsoft Paint*, ISF Omega, and CompuServe GIS.

Compatibility with MHS lets NetFAX interface with a wide range of electronic mail and other programs. The inflexibility of the hardware is a definite disadvantage; however, this is a one-time problem that you should be able to overcome easily with just a little bit of perseverance and some careful planning.

DATA RACE INC.

PC Race 96 FAX/modem

by Bruce Mayfield

The PC Race 96 FAX/modem with *PC Race* fax software from Data Race is a two-fisted combo. It's a contender in the standalone fax/modem market, but it takes a dive in the LAN ring.

On the plus side, the PC Race 96 FAX/modem not only thinks it's a Group III fax machine, but with the optional 24/96 upgrade option it works with most popular communications packages and communicates with several different classes of modem.

Unfortunately, however, fax networking appears to be an afterthought with Data

Race. There is no resident LAN workstation software, and files must be submitted to the fax queue using PC Race utilities and DOS-like commands. The company lists the PC Race 96 FAX/modem at \$795, plus \$250 for the PC Race 24/96 field upgrade; the price is \$995 for the PC Race 24/96 combination package.

The Data Race package runs on any network supporting DOS function calls. The system is configured so that the network file server stores the PC Race programs, utilities, and the fax transmission queue. The documentation for the PC Race card doesn't adequately explain the board's jumper switches and badly needs an index, although the fax software manual is good. The networking documentation is in addenda and READ.ME files without any accompanying network diagrams.

The fax transmission software runs in the gateway PC and polls the file server's fax transmission queue once every 1 to 60

RECEIVING FAXES ON YOUR LAN: The Quality Question

Here are three images of the same fax as received by a conventional fax machine and by a PC. Because the fax a PC receives is a graphic image with an aspect ratio and density different from the

PC's screen, the text is difficult to read. In fact, the image of an incoming fax is often so poor that it serves only to identify the document; you must print it out to examine it in detail. The quality of

output from a laser printer is generally better than the output from the thermal printer on a typical desktop fax machine, but this varies depending on the fax machine and printer used. ■

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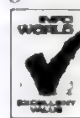
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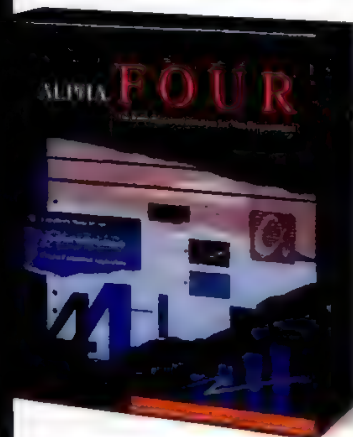
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CONNECTIVITY LAN FAX GATEWAYS

minutes. This program converts files in ASCII and .PCX format into CCITT Group III fax format at transmission time. Pop-up software that is available only on the fax server lets the user capture screens, such as *Lotus 1-2-3* graphs and the output of application print actions, directly into fax format.

Unfortunately, that's about the extent



FACT FILE

PC Race 96 FAX/modem

Data Race Inc., 12758 Cimarron Path, San Antonio, TX 78249; (512) 692-3909.

List Price: PC Race 96 FAX/modem, \$795; PC Race 24/96 field upgrade, \$250; PC Race 24/96 FAX/modem, \$995.

Requires: A LAN using DOS 3.1 file- and record-locking calls, with a shared hard disk in a file server and one PC to act as the fax server. 380K RAM on fax server, 250K RAM on workstation.

In Short: Shoppers seeking a multiuser fax network should keep looking: PC Race lacks adequate workstation software for most users. It's a potential fax platform for application developers but effective only as a standalone fax product.

CIRCLE 542 ON READER SERVICE CARD

of this package's functionality. Data Race needs to make its workstation faxing as user-friendly as its fax server. Until then, the company's PC Race 96 FAX/modem—when compared with other LAN fax gateways—will lose by a knockout every time.

PUREDATA INC.

PureFax

by Kimberly Maxwell

If you're a *Microsoft Windows* aficionado and want a LAN fax gateway for your network, PureData's PureFax is a good bet. PureFax is a *Windows*-based application, with a full-size 9,600-bit-per-second fax modem and an on-board 2,400-bps Hayes-compatible data modem.

PureData packages its Group III-compatible network version for \$1,550, including supervisor and workstation software, a fax-and-modem board with the Rockwell chip set, and cabling. PureFax is compatible with numerous Intel/DCA Communicating Application Specifications (CAS) programs, including *Lotus 1-2-3*, *WordPerfect*, *Q&A*, *cc:Mail*, and

OUR CONTRIBUTORS

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Bruce Mayfield is a computer consultant specializing in business management systems.

Kimberly Maxwell is a newspaper reporter whose specialties include LAN systems. She is a frequent contributor to *PC Magazine*.

C. G. Milligan is a veteran of hundreds of network installations and is the hardware expert at PC LAN Labs.

M. Keith Thompson is a product developer and consultant and a frequent contributor to *PC Magazine*.

Tom Unger is a staff editor in the features section of *PC Magazine*.

LanFax 10. PureFax also allows you to use existing e-mail packages and general application programs on your LAN.

The fax server software runs as a 70K *Windows* application concurrently with other applications. The workstation software requires 29K RAM and utilizes *Windows*' easy-to-use icons. Because of its low RAM requirement, PureFax leaves room for other application software.

PureFax imports files from a number of applications to send as fax data. PureFax can translate .TIF, .PCX, and .IMG graphics files and ASCII text into .PCX format for fax transmission. The PureFax package does not include a graphics editor, but you can invert, rotate, and scale files. The PureFax card also lacks a built-in



FACT FILE

PureFax

PureData Inc., 1740 S. I-35, Carrollton, TX 75006; (214) 242-2040.

List Price: \$1,550.

Requires: A LAN using DOS 3.1 file- and record-locking calls, with a shared hard disk in a file server and one PC to act as the fax server. 74K RAM on fax server, 29K RAM on workstation.

In Short: PureFax is a *Microsoft Windows*-based LAN fax gateway solution incorporating a combination 9,600-bps fax modem and 2,400-bps Hayes-compatible data modem. CAS compatibility and supervisor security features make this a good choice for *Windows* lovers.

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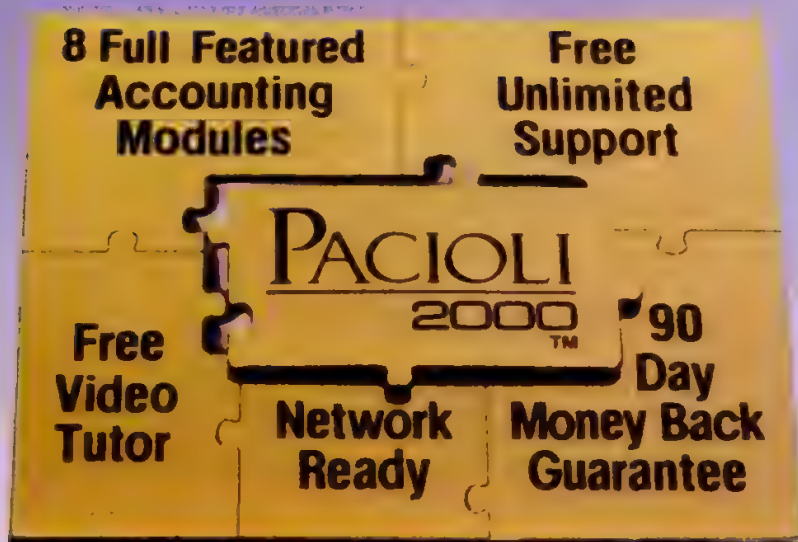
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CONNECTIVITY

LAN FAX GATEWAYS



EDITOR'S CHOICE

•AT&T PagePower

Don't throw away the fax machine yet. While these eight LAN fax solutions will measurably reduce the time it takes to send a fax, they aren't as artful at receiving as they are at sending. For example, none of them routes incoming faxes into the recipient's LAN directory automatically. And on-screen readability of incoming scanned text is low across the board; printing improves the quality, but it's painfully slow compared to a fax machine.

With these limitations in mind, AT&T Information Systems' *Microsoft Windows*-controlled PagePower is clearly our overall winner. You don't have to run *Microsoft Windows* to use the PagePower LAN fax gateway, but this combination provides as complete a fax-handling tool for your network as you can find.

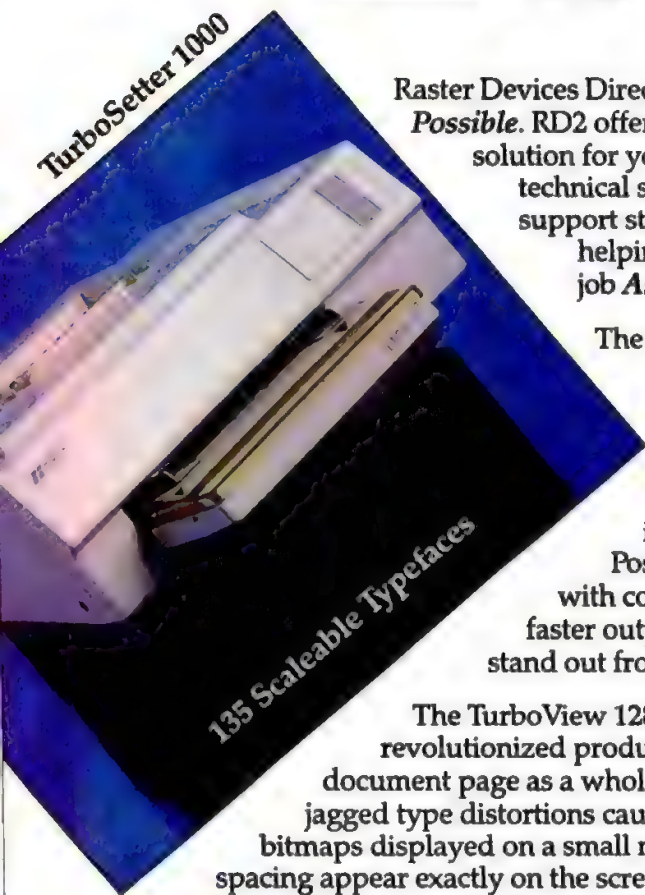
PagePower works easily with a variety of scanners and includes excellent utilities for creating, viewing, printing, and manipulating fax images. The whole package is easily installed and nicely integrated, while AT&T's large sales and service organization provides excellent support. If you need to get your network faxing with a minimum of muss and fuss, PagePower is your best bet.

After AT&T, there are several highly competitive and interesting products in the LAN fax gateway market. The FaxPoint Facsimile Pac/LAN V1.23, for example, is easy to install and uses only a drop of memory. And Castelle's FaxPress comes in its own standalone box, eliminating the need to take up precious space in your server.

scanner interface, so if you want to attach a scanner to the fax server you'll have to sacrifice another expansion slot.

Microsoft Windows' graphical user interface makes this a product with promise. If you favor a graphical user interface for your LAN fax gateway, then think about investing in PC Race.

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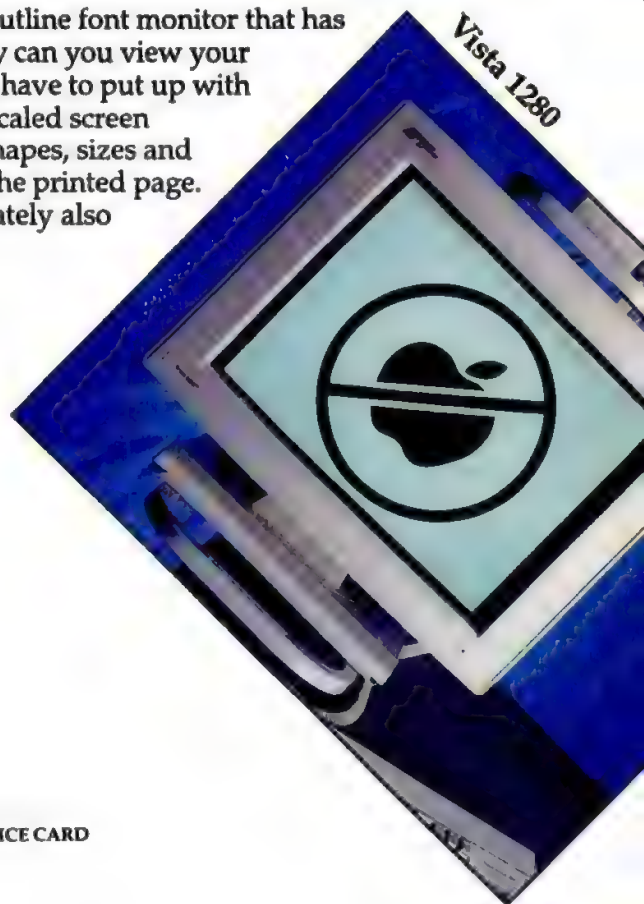
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Peachtree



Software

by
Ethan Winer
and Jay Munro

Utilities

Every program *PC Magazine* has ever published is available for downloading from PC MagNet. That's certainly the easiest way to get a copy of the utilities (and their source code) that appear in this column. But while many readers are waiting for PC MagComm, our complete full-featured communications program for accessing PC MagNet, in this issue we can give you a simple communications program that will allow you to access PC MagNet and a host of other on-line services. In the process you'll get a tour of the capabilities of QuickBASIC.

PCACCESS is designed as an entry-level program. It simply lets you log on, find the files you want, and download them using the CRC Xmodem protocol. Of the dozen or more protocols in general use by on-line services, CRC Xmodem is the most widely supported and by far the easiest to implement. Xmodem is also the least reliable protocol available, but it will serve our purposes here. The protocol is described more fully in the sidebar "How Xmodem Works." Once you've tasted the joys of telecommunications, you may wish to add file-upload facilities and some bells and whistles provided by most shareware or commercial programs. In addition, if you're interested in sharpening your BASIC programming skills using PCACCESS as your starting point, several suggestions along this line are described in the sidebar "Adding Features to PCACCESS."

Probably the most interesting thing to note about PCACCESS is that it is written entirely in Microsoft QuickBASIC. There is no C or assembly language to be found anywhere. Unlike lower-level languages such as C, BASIC includes complete, built-in communications support. In addition to providing sophisticated communication and screen-handling abilities, QuickBASIC is also intuitive and easy to work with. No slouch in speed, it can transfer files at rates up to 9,600 bits per second or even higher, and it can create finished .EXE programs competitive in

Download Utilities The Easy Way with PCACCESS

■ PCACCESS, our first utility written entirely in QuickBASIC, shows off the communications capabilities and sophistication of the language.

size and speed with programs written in other languages. We wrote PCACCESS not only to provide a utility our readers can use to download *PC Magazine* utilities but also to suggest that those of you interested in programming should seriously explore (or perhaps rediscover) BASIC.

PCACCESS.BAS, the source code for PCACCESS, is printed here, as well as being available for downloading from PC MagNet, as described in the sidebar "PC Utilities by Modem." (If you're already a PC MagNet user you may want to download a copy to save a colleague a long typing chore.) It is approximately 20K in length (including comments), and after compiling with QuickBASIC, version 4.5, it produces an executable file size of about 50K bytes.

Because you must modify several of the lines in the source code (to incorporate your own ID number, password, and so on) before compiling the finished program, you will need to have a copy of QuickBASIC (Version 4.0 or later) or of Microsoft's BASIC Compiler (Version 6 or later). Note, too, that unless you're ready to change the various modem command sequences in the source listing, your

modem must be compatible with the Hayes command set (fortunately most modems are Hayes compatible).

Because part of the plan behind PCACCESS is to inspire readers to take a closer (or perhaps another) look at BASIC and to maybe "do a little programming," as our technical editor would put it, we've built the program around the idea of actually supplying the changes necessary for individualized use through the QuickBASIC environment itself. This will require the reader to edit the program, run it from within QB and, finally, to compile the program into its final, personalized form.

However, many of you may only want the utility without all of the need for programming; and many of you will not have access to QuickBASIC (you cannot use BASICA or GW-BASIC). Because of this, we have created a slightly different version of PCACCESS, PCACCESS1, that can create and read a simple, ASCII-based configuration file to obtain all the information it needs for personalized use. You would run PCACCESS1 as you would any other utility. It is available on PCMagNet for downloading, or by sending a written request with a SASE and fax number (if applicable) to Utilities, One Park Avenue, New York, NY, 10016; Attention: Carolyn Falconer. No phone calls, please.

The discussion of PCACCESS here is directly applicable to PCACCESS1. A readme file accompanying PCACCESS1 will provide minor additional information for its use. Other than the fact that one utility reads a configuration file to obtain the proper phone number, ID, and password,

Utilities

and the other has the information hard-coded, the programs are nearly identical.

CREATING AND USING PCACCESS

We'll assume at this point that you don't yet have a CompuServe or PC MagNet account (you need a credit card to join) and that you've entered the source code and so are in the QuickBASIC environment. In the source listing (about 40 lines from the top) you'll see the following lines:

```
ComSpec$="COM1:1200,E,7,1,BIN,CS0"  
' note: use the following line  
after joining PC Magnet and  
adjusting your user profile for no  
parity. Change COM1 and 1200 as  
necessary.  
'ComSpec$="COM1:1200,N,8,1,BIN,CS0"
```

To find the above lines quickly, you can simply use QB's Search/Find commands, Alt-S and Alt-F, to search for ComSpec. The QB environment will place you exactly on the string.

Just below the lines listed above, you'll find (stripped here of their explanatory comments)

```
Dial$ = "9,18003463247"  
DialCmd$ = "ATDT"  
'DialCmd$ = "ATDP"  
'IDStr$ = "177000,5000"  
'Password$ = "PC*MAGAZINE"
```

If you look at the sidebar "PC Utilities by Modem," you'll see that these lines set you up to make your first two calls into PC MagNet: first to get a local phone number to use thereafter; then to join up and get your user ID and password. At this point you might need to change only a few things in the code lines shown above. In

the ComSpec\$ line, change COM1 to COM2 if your modem is connected to the COM2 port; and change from 1,200 to 300 in the rare event that 300 bps is the maximum bps of your modem. You might also move the initial apostrophe (which turns the line into a comment rather than an instruction) to the front of the *other* DialCmd\$ line if your telephone uses pulse (ATDP) rather than tone (ATDT) dialing.

If dialing in your area requires a 1 before the area code, simply include it. If you are calling from a phone system that requires a 9 or some other digit to be dialed before the actual phone number, include the number and a comma before the phone number. For example, to dial 9, pause and wait for a dial tone, then to dial 1 and the number, the correct string becomes

```
Dial$ = "9,18003463247"
```

This done, while still in the QuickBA-

HOW XMODEM WORKS

by Jay Munro

The original Xmodem protocol was developed by Ward Christiansen and was one of the first widely recognized communication protocols for use with personal computers. Although it is a very simple concept, Xmodem has made binary file transfer possible between a variety of systems. Versions are available for almost every PC, from the lowly TRS-80 Model 1 to multiuser 386 systems.

The first Xmodem protocol, shown in Figure A, is called Checksum, and it consists of a block of characters beginning with a CHR\$(21) "Start of header" character (SOH). The second character is the current block number, and the third is the "ones complement" of the block number. To derive the ones

complement of a number, it is XOR'ed with the value 255. By transmitting both the block number and its complement, an extra measure of safety against transmission errors is gained. The block sequence characters are MOD 256, since they are 8-bit characters. When the count exceeds 255, the value wraps around to begin again at zero. However, most programs maintain their own count internally for an accurate accumulated total. Beginning at the fourth character and following for 128 characters is the actual data that is being transmitted. Finally, the last character in the block is the Xmodem checksum value assigned to the block.

When using the Xmodem Checksum protocol, the checksum value is 1 byte long. It is calculated by adding the

ASCII values of each of the 128 characters and then ANDing the sum with 255. This 1-byte checksum is reasonably accurate, although it can possibly miss some errors, such as transposed characters. For this reason, the Checksum protocol is less popular than it once was, though almost all bulletin boards and other on-line services continue to support it.

Because of the limited accuracy of the Checksum Xmodem protocol, a better system was developed subsequently. As shown in Figure B, this newer method—called Xmodem CRC—uses the same block structure but adds a 2-byte check value instead of 1 byte. The 2-byte value is calculated by a 16-bit cyclic redundancy check (CRC-16) formula. The CRC formula



THE CHECKSUM PROTOCOL



Figure A: The Checksum protocol was the first protocol used by Xmodem.

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SIC environment, press Shift-F5. This will start PCACCESS from the QB environment, and you should then see the opening PCACCESS screen. As shown in Figure 1, PCACCESS uses a very simple screen to display prompts, show data, and accept user input. The top three lines are protected from scrolling by QB's VIEW PRINT command, which here restricts scrolling to the "window" between lines 4 and 25. All messages and other text are displayed within this window.

The first message you see will be a "Modem Ready" message. At this point hit Alt-D, and PCACCESS will dial the 800 number and log you on. When a connection is made, you will see a 1200 appear. At this point hit the return key. When Host Name appears, enter the word

PHONES and simply follow the prompts to obtain a local access number. Note, however, that there will be a different

number to call if you'll be using your modem at 2,400 bps rather than at 300 or 1,200 bps. After CIS gives you your num-

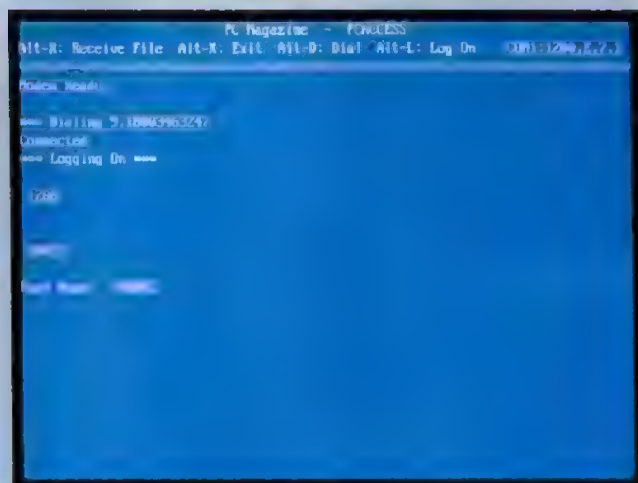


Figure 1: While still in QuickBASIC, press Shift-F5 to get the opening screen of PCACCESS. Pressing Alt-D prompts the utility to log on to the Phones database at CIS.



Figure B: The Cyclic Redundancy Check (CRC) protocol subsequently used by Xmodem claims an accuracy rate of 99.9 percent.

is too complex to discuss here, but it has a claimed accuracy of up to 99.9 percent. (The older Checksum method is approximately 60 percent accurate.)

Programs that use the CRC formulas may either calculate the CRC on each block or use a lookup table. Because the table method results in much faster file transfers, that is the approach we implemented in PCACCESS.

Each 8-bit character has a unique CRC value. With only 256 possible characters for 8 bits, the CRC is calculated ahead of time and a table is built. The table may be hard-coded or it may be calculated when needed, as done in PCACCESS. The table is calculated at the start of the program by dimensioning an integer array to 256 elements (including element 0). A FOR/NEXT loop is used to calculate the unique values, and the array is then filled with the

results of each calculation. During a file transfer, the ASCII value of each character acts as an index into the array, and the appropriate CRC value is returned. The program then needs a simple calculation to find the CRC for the entire block.

Although calculating a CRC for the entire block does take a finite amount of time there is a saving, since the CRC value of each character is already known. Our tests showed a reduction in transfer time of more than one-third when compared with calculating the CRC for each character as it is received. The Xmodem protocol transfers information in only one direction at a time (called half duplex); that is, the receiving program prompts the sender to transmit each block. Further, the sender always waits for an acknowledgement before sending the next block. In more-

sophisticated file transfer systems, multiple blocks may be sent at a time.

Another protocol that is available, Ymodem, is even more sophisticated. Ymodem uses a similar CRC-based protocol, but it also sends a header block to relay the filename and other information. Ymodem transfers data in 1,024 byte blocks and can also transfer multiple files in a batch mode. With Ymodem and other similar protocols that use large blocks, more time is spent transferring data and less is wasted calculating checksums and sending acknowledgements.

To learn more about file transfer protocols, use the "file finder" utility to investigate resources on PC MagNet and CompuServe. PC MagNet maintains a file finder on the Utilities forum menu; it will help search multiple forum libraries.

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ber, it will log you off, and you will get a NO CARRIER message (see Figure 2). Hit ALT-X and you will be returned to the QuickBASIC environment.

You now must change the 800 number in Dial\$ and, if appropriate, change your modem speed from 1,200 to 2,400 in ComSpec\$. Finally, remove the apostrophe from in front of each of the lines IDStr\$ = "177000,5000" and Password\$ = "PC*MAGAZINE" to turn them into executable lines (rather than comments).

You're now ready to join PC MagNet and get your ID and a temporary password. (CompuServe will mail you your permanent ones later.) To sign up, simply follow the instructions in the "PC Utilities by Modem" sidebar. The password is known only to you and often consists of a pair of words separated by a non-alphanumeric character—BROWN+SHOES, for example. Never reveal your password to someone else, because you are ultimately responsible for all access charges.

Let's detail the steps here. Press Shift-F5 and proceed as before. PCACCESS will log you on and will ask you for an Agreement Number. You enter Z10D9001, and you will go through an introductory procedure with CIS that will in-

clude some basic information for you to read and some questions to answer. Eventually you will be given your permanent ID number and a temporary password. Once you have them, CIS will let you log on to the service for the first time. Again, simply go through the information. When asked to select a terminal type, choose OTHER.

Finally when you arrive at the ! prompt, type GO PROFILE, and select menu choice 1 (Terminal settings). Next select 2 (Change Permanent Settings), select 4 (Terminal Type/Parameters), select 8 (Parity), select 3 (Zero, or none), hit the

return key and select 6 (Make session settings permanent), and then hit 1 to confirm. When done, type BYE and you will be logged off PC MagNet and CIS.

Whenever you are ready to leave PC MagNet, always remember that you must log off by typing BYE at any ! prompt. If you exit PC MagNet simply by hanging up, you may be charged up to 15 minutes additional connect time. (CompuServe allows this period of inactivity in case you're away from your PC when a transfer finishes, but it will disconnect by itself if you don't enter anything for 15 minutes.)



Figure 2: Once CIS has given you a local access number, it automatically logs you off, as indicated by a NO CARRIER message. You must then go back to the code, delete the 800 number, and enter the local one in its place.

ADDING FEATURES TO PCACCESS

by Jay Munro

One of the best reasons for using a utility such as PCACCESS is that it gives you an opportunity to build your programming skills by making modifications to the program. Carefully examining another's efforts is one of the best ways to learn more about programming. By starting with a simple working framework, you can then modify and customize until the program works exactly the way you want it to. Since PCACCESS was written with a very limited aim, it offers plenty of scope for modifications. Here are a few suggestions.

Text logging is useful for keeping a file of your activity on a new forum and for capturing messages. The components required are an additional hotkey recognized in the SELECT CASE loop, plus a small amount of file han-

dling code. As each character is received from the modem, simply write it out to a disk file. As long as you add the new code in a separate portion of the program, it will not interfere with normal Xmodem file transfers.

An upload feature would reduce connect time by letting you answer messages off-line with a text editor (so your thinking time isn't charged) and then upload and send them. In order to add this option, you again need to add a separate test to the SELECT/CASE block—perhaps using Alt-U as the hotkey. When that key is detected, the program opens the file to be sent for sequential input and prints its contents, line by line, to the modem. Xmodem isn't needed to send normal ASCII text, so only simple INPUT and PRINT statements can be used.

But if you're that ambitious, send-

ing files by Xmodem will enable you to upload any program to PC MagNet for others to use. To add this upload capability, build the block string using the SOH character, a block number, the ones complement block number, and 128 bytes of data, followed by a 2-byte CRC. Then use QuickBASIC's binary file input capability to GET an input block from the file and PUT it to the modem port. The CRC calculator will work as well on outgoing strings. Bear in mind, however, that when sending binary data, you must not send a terminating carriage return or line feed. Therefore, all PRINT statements to the modem will require a trailing semicolon. You will also need to examine the modem for NAK, ACK, and CAN characters from the receiving terminal to ensure that the transfer is progressing without error. ■

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80-column CGA Text
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Utilities

BINARY DOWNLOADS

Once you are back in the QuickBASIC environment, you still have two more tasks to accomplish before you can set up PCACCESS. Go back to the ComSpec\$ line, place an apostrophe in front of the ComSpec\$ line you have been using, and remove the apostrophe from the second ComSpec\$ line to make it the executable line. Remember to change COM1 to COM2 and 1,200 to 300 or 2,400 as necessary. This line sets up the program for 8-bit (binary) transfer.

Finally, you will need to enter your new ID and password strings as IDStr\$ and Password\$, respectively. Be careful as you type them in: any extra characters or spaces will be interpreted as part of the response and will prevent you from accessing the system. (When your permanent password arrives in the mail, you will need to change the Password\$ line one final time.)

The last step while you are still in the QuickBASIC environment is to compile and link the program, thus creating the final .EXE file. Because PCACCESS is written completely in QuickBASIC, it may be compiled directly from within the editing environment. To compile, press Alt-R, select X for executable file, and then press the Tab key to select the Stand-alone EXE File option. You can, in fact, simply use the defaults presented. If you are going to be using a 286 or 386 machine, be sure to select the option to create 286 code. The relevant screen is shown in Figure 3. Finally, select the Make EXE and Exit options, and QuickBASIC will create the executable file for you.

DOWNLOADING FILES WITH PCACCESS

PCACCESS does not require any additional data files for its operation, so it can be started from any drive or directory. By putting PCACCESS.EXE in a directory that is listed in your DOS PATH setting, file transfers may be initiated from any target directory, eliminating the need for you to enter a pathname when using the program.

PCACCESS is also extremely easy to use since it has a simple command set, listed as follows:

- Alt-D—Starts the Auto-log-on sequence.
- Alt-L—Resends the Log-on sequence

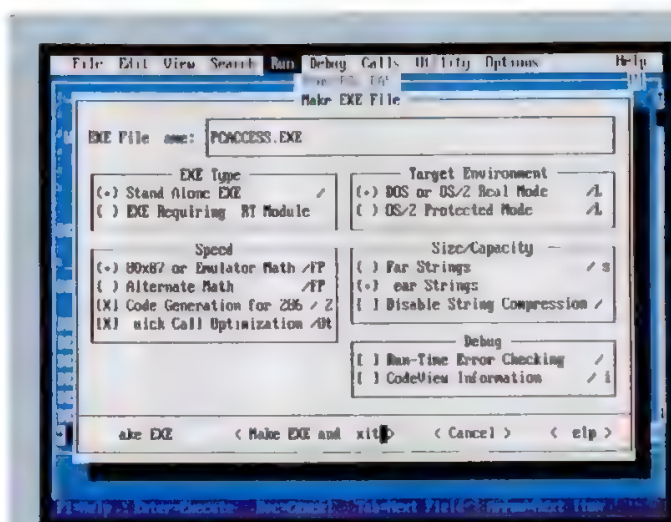


Figure 3: QuickBASIC allows you to compile code directly from within the environment. Pressing Alt-R pops up the appropriate screen; the default options are marked off with bullets.

(in case there should be errors).

- Alt-R—Starts Xmodem file transfer (receive only).
- Alt-I—Places PCACCESS in Immediate Mode. This option does not appear on the top menu.
- Alt-C—Sends three Cancel characters (used after an error or time-out). This option does not appear on the top menu.
- Alt-X—Exits the program.

PCACCESS has one command-line option, I, which tells PCACCESS to

PCACCESS contains a one command-line option, I, which tells the program to prompt for a utility name, download that utility, and sign off PC MagNet.

prompt for a utility name, immediately download the utility, and sign off PC MagNet.

To begin the program, simply type PCACCESS (or PCACCESS I) and press enter. PCACCESS will initialize the modem with the ATZ command and give you a "Modem Ready" message. You then

start the auto-log-on process by pressing Alt-D. PCACCESS sends the modem an ATDT (for tone, ATDP for pulse) command, followed by the phone number you entered into the program. After the dialing commands and number have been sent, the modem waits for a carrier tone from PC MagNet. Once a successful connection has been established, the modem will then send a "CONNECT" message back to PCACCESS. (The exact message may vary among modem brands. If you experience difficulty, write the message down and enter it *exactly* in place of the "CONNECT" shown in the Logon subroutine part of the source text.) Upon receiving a "CONNECT" response, PCACCESS continues the log-on procedure by sending the ID and Password to PC MagNet.

Note that if you have trouble logging on and receive a Device Error message or jibberish on the screen, you should simply try dialing again. Sometimes it is difficult to log onto CIS itself. There is no problem at this point from PCACCESS's end. It simply cannot get through to CIS.

Occasionally, because of network problems, bad telephone lines, or just poor timing, the network may not respond to your initial log-on attempt. If CIS seems to be taking too long—more than 20 seconds or so—press Enter to break out of the log-on sequence. Because you are still connected to PC MagNet and merely need to resend the log-on, press Alt-L to retry. The second try will usually be successful. Repeated messages from the network such as "Login Invalid, try again," can mean that your ID or Password have not been entered correctly. In that case, carefully check your spelling and punctuation in the

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IDStr\$ and Password\$ variables.

A display of the PC MagNet logo and copyright notice, followed by a number of messages and an opening menu, signal a successful log-on. Navigating through PC MagNet is as easy as selecting an item from the menu. Further, help is always available if the choice is not obvious. First-time users are encouraged to experiment in the practice forum, where no charge is incurred and where newcomers can experiment with many of the finer points of PC MagNet and CompuServe. To exemplify the procedure, we'll walk you through the download of a short utility from the PC MagNet practice forum.

To get to the Practice forum from PC MagNet's main menu, select choice 4, Forums. At the Forum menu select choice 5, Practice forum. The first time you access a forum you must "join" it (PC MagNet imposes no charge for this, though some CIS services do). To join any forum, type JOIN at the exclamation prompt and answer the prompt for your name. You're now a member.

After reading a short message from the SysOp (systems operator), you enter the forum library by selecting 3, Libraries. A very useful short course on PC MagNet is contained there in a file called PCMAG.COM. The file is about 27K in length, and downloading it will provide a good trial run for learning PCACCESS. (Once you have successfully downloaded PCMAG.COM onto your PC, you simply run it to create the text file containing the instructions.)

Downloading a file with PCACCESS is very easy. From the library menu, select Download. When PC MagNet asks for the name of the file to retrieve, type PCMAG.COM and press Enter. PC MagNet now needs to know what downloading protocol you wish to use, so it displays a list of available choices. Select Xmodem from the list and press Enter. PC MagNet is now ready to send the file; it quietly waits for PCACCESS to signal that everything is ready at your end to start receiving.

To enable PCACCESS's downloading facility, press Alt-R. PCACCESS will now prompt you for a filename. Generally, you'll simply enter the same name that PC MagNet uses, though you can substitute any legal filename and may precede it, if you wish, with a drive and path. Once

the name has been entered, PCACCESS will acknowledge the protocol that PC MagNet is using, and before you know it, you've begun to receive blocks of data.

During the file transfer, no further action is needed: you simply sit there, following the progress of the transfer by

watching the block number and total number of bytes received thus far. Because the Xmodem protocol can send only complete blocks of 128 characters, the size of the files you receive will always be a multiple of 128; if the last block is shorter than 128 bytes, the transmitting program will pad it

PC UTILITIES BY MODEM

The programs published in *PC Magazine* are available by modem from PC MagNet.

To join PC MagNet, set your communications software for either 300 or 1,200 bits per second, 7 data bits, even parity, 1 stop bit, and full duplex. To find the number nearest your dialing exchange, dial (800) 346-3247. When the modem connects, press Enter. At the HOST NAME prompt, enter PHONES. Follow the menus and note the number closest to you.

After you have found the phone number nearest you, hang up and redial using that number. When you connect with PC MagNet, press Ctrl-C. At the HOST NAME prompt, enter CIS. At the USER ID prompt, enter 177000,5000. Enter PC*MAGNET at the PASSWORD prompt and Z10D9007 at the ENTER AGREEMENT NUMBER prompt. For Customer Service, call (800) 848-8990; outside the United States, call (614) 457-8650.

To download PCACCESS.EXE and its QuickBASIC listings, log on to PC MagNet. Enter GO UTILITIES or choose PC MAGAZINE UTILITIES from the top menu, then DIRECT UTILITY DOWNLOAD from the next menu. Enter the filename, then select the file you want to download from those presented. Answer yes (Y) to DO YOU WISH TO DOWNLOAD? Press Enter to see the transfer protocols. Choose a protocol and download the file.

You don't have to be a member of CompuServe to access PC MagNet. It costs \$12.80 an hour for 1,200/2,400-bps service and \$6.30 for 300-bps, via MasterCard, VISA, or American Express. These programs can be copied but are copyrighted and are made available only for noncommercial use. You may make copies for others as long as no charge is involved, but making

copies for any commercial purpose is prohibited.

Like all good software, the programs presented in *PC Magazine* are upgraded and improved. The only way to obtain the modified versions is to download them from PC MagNet. Here is a partial list of the programs that have been upgraded to fix minor bugs and system incompatibilities:

ANSI.COM, Version 1.3
BEN51.EXE (Benchmark Tests, Version 5.1)
CARDFILE.COM, Version 1.1
CHKFRAG.EXE, Version 1.2 (now works with volumes greater than 32MB)
DIRMATCH.COM, Version 1.1
EMS40.SYS, Version 1.1 (fixes a problem with Lotus 1-2-3)
LITES.COM, Version 1.1
LOG.COM, Version 1.1
PCMANAGE.EXE, Version 1.1
RN.COM, Version 2.0 (now works under DOS 4.x).
SLICE.COM, Version 1.3
SNIPPER.COM, Version 1.2
ZCOPY.COM, Version 1.2

For a complete list of all the programs available from the PC MagNet Utilities Database, download UDCAT.ARC.

A downloadable index to *PC Magazine*'s product reviews is also available. PCM.EXE is a self-extracting file that contains the *Computer Library PC Magazine Reviews Index* for January 1988 to June 1989. This easy-to-use database is a subset of the *Computer Library Periodicals Database*, which is available on CD-ROM and on PC MagNet. It requires the search files in PCSRCH.EXE.

PCSRCH.EXE is a self-extracting archive containing the software used to retrieve citations from the *PC Magazine Reviews Index*. Please read the information file PCM.INF before you download any of these files. ■

Six reasons your business should upgrade to the new Lotus Symphony 2.2

People like you in corporations throughout the world have chosen Lotus® Symphony® for its advanced spreadsheet, fully integrated modules, windowing facility and powerful command language, not to mention unparalleled service and support. And now the new Symphony 2.2 brings you a host of advanced features that let you perform more sophisticated analysis, build bigger applications and present your ideas with more impact. Here are six reasons why you should upgrade right away:

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2 **View any file on disk before you retrieve it.**
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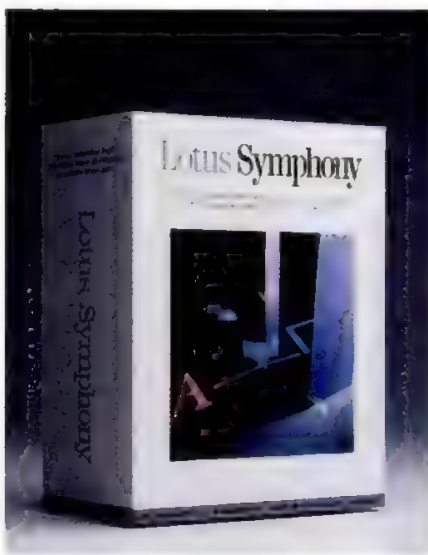
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Lotus Symphony 2.2

System Requirements: Minimum 512K RAM. 640K for use with large add-ins. DOS level 2.0 or higher. Symphony runs on IBM XT, AT, PS/2 Models, COMPAQ computers, plus Lotus-certified compatibles. Hard disk required.

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Utilities

up to 128 bytes with zeros. Although this is usually harmless, it can be disconcerting to the uninitiated. If the transfer must be cancelled, press Alt-C. PCACCESS will close the file on your machine, then send a termination character to PC MagNet.

When the file transfer is completed PCACCESS signals with a chime, displays the total number of blocks and bytes received, and then returns to the main program. PC MagNet expects a carriage return when the transfer is complete, so press Enter to confirm the transfer. At this point you may select another file to download or continue exploring the forum.

Alt-I, Immediate Mode, is very handy. It will automatically go through the download process for you from any place you

may be. Say, for example, that you are browsing through files or you read a message and it mentions some program you would like to have. Without the need to go through various menu stages, press Alt-I, enter the filename, and PCACCESS does the rest.

Again, when you decide to log off, don't forget to enter BYE at one of the exclamation prompts, or you'll inflate your CompuServe bill unnecessarily. Pressing Alt-X will then take you back to the DOS prompt.

Using the Alt-I command-line option tells PCACCESS to prompt you for a filename. No further action is required on your part. Once the filename is entered, PCACCESS goes directly to work downloading the file. Once downloaded, PCACCESS immediately exits. This option is useful for absolutely minimizing the amount of time spent on CIS.

PCACCESS PROGRAM DETAILS

The complete source code listing for PCACCESS is shown in Figure 4. As you can see, PCACCESS makes use of several features introduced in QuickBASIC 4. The general communication loop begins at the label OpenSerialPort, with the QuickBASIC statement

```
OPEN ComSpec$ FOR RANDOM AS #1
```

Any subsequent reading or writing then specifies that file number for access. The ComSpec\$ variable contains the communications parameters, specifying the port to open, bps rate, parity, and stop bits. Notice that in order to allow both reading and writing, PCACCESS opens the file for random access.

In general, writing and using a communications program in QuickBASIC is very straightforward, but—as always—there

PCACCESS.BAS

```

'----- PCACCESS.BAS - QuickBASIC communications and file download utility
'Written for PC Magazine by Jay Munro
'
' Compile and Link syntax:  BC /o/x PCACCESS;
'                           LINK /ex PCACCESS;

DEFINT A-Z                               'Use integers unless over-ridden

'----- QuickBASIC Subprograms
DECLARE SUB AbortFile (FileName$)         'Clears buffer, closes file
                                           'Checks blocks for errors
DECLARE SUB CheckBlock (Message$, Status, Ptr, CRCTable())
DECLARE SUB FlushBuf ()                   'Flushes COM buffer
DECLARE SUB Immediate (CRCTable(), PromptData$) 'Direct download routine
DECLARE SUB Logon (X)                     'Auto-logon routine
DECLARE SUB MakeCRCTable (CRCTable())     'Builds CRC value table
DECLARE SUB XModemSub (CRCTable())        'XModem handler

'----- QuickBASIC Functions
DECLARE FUNCTION CRCcalc$ (A)             'CRC value function
DECLARE FUNCTION FilterIn$ (InString$)    'Filters out special characters
DECLARE FUNCTION GetString$ (SearchStr$, ExitCode) 'Finds ID/Password/etc.

ON ERROR GOTO ErrorCheck                  'Directs errors to trap area

'----- Set up shared variables
DIM SHARED ACK$, CHMS, EOT$, HANS, SOS$, BlockOK, CurBlk%
DIM SHARED Dial$, DialCmd$, ErrCount, IDStr$, Password$, Quit$
DIM SHARED DirectPlay$, FileName$

'----- Set program constants
ACK$ = CHR$(6)                            'Acknowledge Character
CHMS = CHR$(24)                           'Cancel transmission
EOT$ = CHR$(4)                             'End of Transmission
HANS = CHR$(21)                           'Negative Acknowledge
SOS$ = CHR$(1)                             'Start of Header
Quit$ = CHR$(8) + CHR$(30)                'Abort File Character ALT-A

COLOR 7, 1                                'Set colors of display

REDIM PromptData$(7, 2)                    'Array for direct download commands
REDIM CRCTable$(255)                       'Dim an array for table

CALL MakeCRCTable(CRCTable())              'Fill the table

' notes: change COM1 and 1200 as necessary below
ComSpec$ = "COM1:1200,E,7,1,BIN,C80"

' notes: use the following line after joining PC MagNet and adjusting
' your user profile for no parity. Change COM1 and 1200 as necessary.
'ComSpec$ = "COM1:1200,N,8,1,BIN,C80"

'----- Put in your own number, ID, and Password here
Dial$ = "9,10003463247"                    'String to hold phone number
DialCmd$ = "ATDT"                          'Hayes command for Tone dialing
'DialCmd$ = "ATDP"                          'Use this sequence for pulse dialing
IDStr$ = "177000,5000"                     'String to hold ID
Password$ = "PC*MAGAZINE"                  'String to hold password

```

```

'----- Clear screen and display help and logo
CLS
LOCATE 1, 1, 1                             'Print logo, help and comspec
PRINT TAB(20); "PC Magazine - PCACCESS"
PRINT "Alt-R: Receive File Alt-X: Exit Alt-D: Dial Alt-L: Log On ";
PRINT LEFT$(ComSpec$, 15);
PRINT STRING$(80, 20);
VIEW PRINT 4 TO 24                          'Use area between lines 4 and 24
GOSUB ScriptData                             'Load array of direct download commands

'----- Open the COM port
OpenSerialPort:
OPEN ComSpec$ FOR RANDOM AS #1              'Open communications buffer
                                           'Put additional set-up here if needed
PRINT #1, "ATZ"                             'Reset modem

OK = GetString$("OK", ExitCode$)           'Hold until modem returns an OK
IF OK THEN                                  'If OK then print modem ready
    PRINT "Modem Ready"
ELSE
    PRINT "Modem not responding - press ALT-X to quit"
END IF

IF INSTR(COMMAND$, "I") THEN DirectPlay$ = 1 'I on command line
IF DirectPlay$ THEN CALL Immediate(CRCTable(), PromptData$())

'----- Main input handler
InputLoop:
    IS = INKEYS
    IF LEN(IS) THEN
        I = ASC(RIGHT$(IS, 1))
        IF LEN(IS) = 2 THEN I = -I
        SELECT CASE I
            CASE -23
                DirectPlay$ = -1
                CALL Immediate(CRCTable(), PromptData$())
            CASE -45
                EXIT DO
            CASE -32
                CALL Logon(0)
                PRINT
            CASE -38
                CALL Logon(-1)
                PRINT
            CASE -19
                CALL XModemSub(CRCTable())
            CASE ELSE
                PRINT #1, IS;
                'Send anything else to the modem
                'Semi-colon prevents sending CR/LF
        END SELECT
    END IF

    IF NOT EOF(1) THEN
        NInput$ = INPUT$(LOC(1), #1)
        PRINT FilterIn$(NInput$);
    END IF

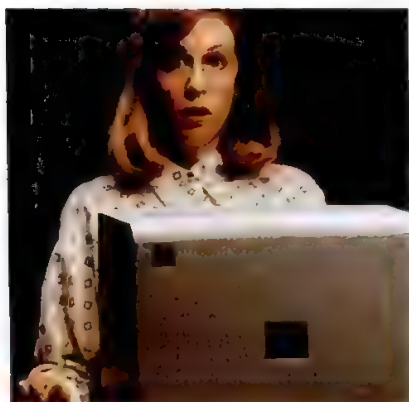
    LOOP
CLOSE
END
ErrorCheck:
SELECT CASE ERR

```



Figure 4: PCACCESS is composed of one executable file written in QuickBASIC, a language with built-in communications support.

You are surrounded by a bunch of losers.



"Uh, my system crashed and my file disappeared."



"Have you ever had one of those days?"



"My dog ate my data."



"I can't believe that it's my fault, it's your system."



"Nobody told me that I was supposed to back up."



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```

CASE 24
PRINT "Device Timeout!"
CASE 52
PRINT "Bad File Name!"
CASE 53
PRINT "File not found!"
CASE 57
Err57a = Err57a + 1
IF Err57a > 5 THEN
PRINT "Device I/O Error!"
Err57a = 0
END IF
CASE 61
PRINT "Disk full!"
CASE 68
PRINT "Device Unavailable!"
CASE 69
PRINT "Buffer Overflow - Fatal"
CLOSE
END
CASE 71
PRINT "Drive not ready!"
CASE 75
PRINT "Path/File access error"
CASE 76
PRINT "Path not found"
CASE ELSE
PRINT "Error "; ERR: " Occurred"
END IF
END IF
IF INKEY$ <> "" THEN END
RESUME
ScriptData:
RESTORE DirData
FOR X% = 1 TO 7
READ PromptData$(X%, 1)
READ PromptData$(X%, 2)
NEXT X%
RETURN
DirData:
'Direct download commands
DATA 1,GO UTILITIES,1,4,"":",,":",Y,<CR>,,transfer:1,complete,,
SUB AbortFile (FileName$) STATIC
CALL FlushBuf
PRINT @1, CAN$; CAN$; CAN$;
PRINT "!!! File transfer cancelled !!!"
CLOSE #2
END SUB
SUB CheckBlock (Message$, Status$, Ptr$, CRCTable$()) STATIC
Status$ = 1-OK get more (saved)
'
' 2-Retry block
' 3-sender Abort
' 4-End of file (close)
Blockok$ = 0
SELECT CASE LEFT$(Message$, 1)
CASE "O"
Status$ = 4
'End of Transmission (good)
CASE "C"
Status$ = 3
'Canceled by sender (not so good)
CASE "<"
Status$ = 3
'Start of Header bad (out of sync)
IF Ptr$ < 10 AND CurBlk$ = 1 THEN 'probably start of file
PRINT @1, "C";
Status$ = 3
'Set status for retry
ErrCount$ = ErrCount$ + 1
'bump error count
CASE ELSE
Status$ = 1
PRINT "SON error"
CALL FlushBuf
CASE ELSE
Blockok$ = (CurBlk$ AND 255) = ASC(MID$(Message$, 2, 1))
Blockok$ = (ASC(MID$(Message$, 2, 1)) XOR 255) = (ASC(MID$(Message$, 3, 1)))
IF Blockok$ THEN
CRC$ = CHR$(0) + CHR$(0)
' Message CRC created in this routine
FOR M% = 4 TO 131
CRC$ = CRC$ + CHR$(0)
' Each character is considered and
' CRC on total message is created
CRC1$ = ASC(CHR$(CRC$, 1))
CRC2$ = CVI(CHR$(0) + RIGHT$(CRC$, 1))
CRC1$ = M% XOR CRC1$ XOR ASC(MID$(Message$, M%, 1)) XOR
CRC2$
CRC$ = RIGHT$(CRC1$, 1) + LEFT$(CRC2$, 1)
NEXT M%
Status$ = 1
'Preset status to get next block
IF CRC$ = MID$(Message$, 132, 2) THEN
Blockok$ = -1
'It is good:
ELSE
PRINT "CRC error"
Blockok$ = 0
Status$ = 0
END IF
ELSE
Status$ = 1
PRINT "Block ID error"
END IF
END IF
IF NOT Blockok$ THEN
'If block is bad then
ErrCount$ = ErrCount$ + 1
'bump error count, and report the
' block number that is at fault
PRINT "!!! Error - block "; CurBlk$
PRINT "!!! Error count "; ErrCount$
PLAY "L160JEC"
END IF
END IF
FUNCTION CRCCalc$ (A$)
MICRO$ = MICRO$ XOR A$
LOCRC$ = 0
FOR CT% = 0 TO 7
Carry = 0
IF MICRO > 127 THEN Carry = -1
MICRO = (MICRO + 3) AND 255
IF LOCRC > 127 THEN MICRO = MICRO + 1
LOCRC = (LOCRC + 3) AND 255
IF Carry THEN
MICRO = MICRO XOR 16
LOCRC = LOCRC XOR 33
END IF
NEXT CT%
CRCCalc$ = CHR$(LOCRC) + CHR$(MICRO)
END FUNCTION
FUNCTION Filtnp$ (InString$) STATIC
DO
Backspace = INSTR(InString$, CHR$(8))
IF Backspace THEN
MID$(InString$, Backspace) = CHR$(29)
END IF
LOOP WHILE Backspace
'----- Strip out any line feed characters
DO
LineFeed = INSTR(InString$, CHR$(10))
IF LineFeed THEN
InString$ = LEFT$(InString$, LineFeed - 1) + MID$(InString$, LineFeed + 1)
END IF
LOOP WHILE LineFeed
Filtnp$ = InString$
END FUNCTION
SUB FlushBuf
IF LOC(1) THEN
DO UNTIL EOF(1)
Junk$ = INPUT$(1, 1)
LOOP
END IF
END SUB
FUNCTION GetString$ (Search$, ExitCode$) STATIC
GetString$ = 0
Timeout$ = TIMER + 5
Minput$ = ""
DO
IF INKEY$ <> "" THEN
ExitCode$ = -1
EXIT FUNCTION
END IF
IF TIMER > Timeout$ THEN EXIT FUNCTION
IF LOC(1) THEN Minput$ = Minput$ + INPUT$(LOC(1), 1)
LOOP UNTIL INSTR(Minput$, Search$)
GetString$ = -1
END FUNCTION
SUB Immediate (CRCTable$, PromptData$())
PRINT "Immediate Mode - Enter file to download:"
INPUT FileName$
IF FileName$ = "" THEN GOTO OutHere
PRINT "Press ENTER to quit"
PromptData$(3, 2) = FileName$
IF DirectFlag$ = 1 THEN
CALL Logon(0)
ELSE
PRINT @1, "GO PCM-1"
END IF
FOR X% = 1 TO 7
DO
IF ExitCode THEN PRINT "Cancelled"
OK = GetString$(PromptData$(X%, 1), ExitCode)
IF OK THEN
PRINT PromptData$(X%, 2)
PRINT @1, PromptData$(X%, 2)
LOOP UNTIL OK
NEXT X%
OK = GetString$(PromptData$(7, 1), ExitCode)
CALL XModemSub(CRCTable$())
PRINT @1, " "
OutHere:
DirectFlag$ = 0
END SUB
SUB Logon (LogonOnly$)
ExitCode$ = 0
IF NOT LogonOnly$ THEN

```


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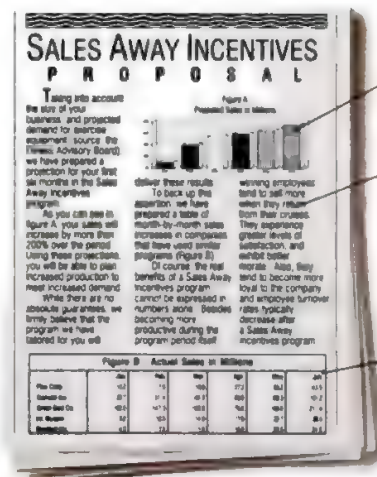
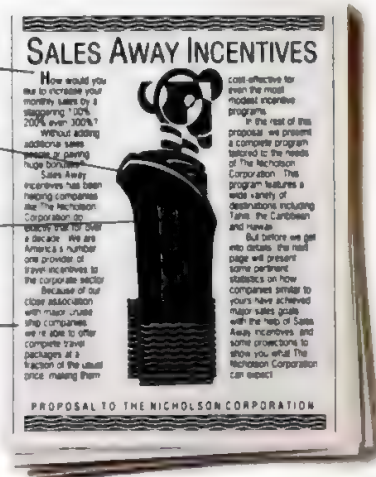
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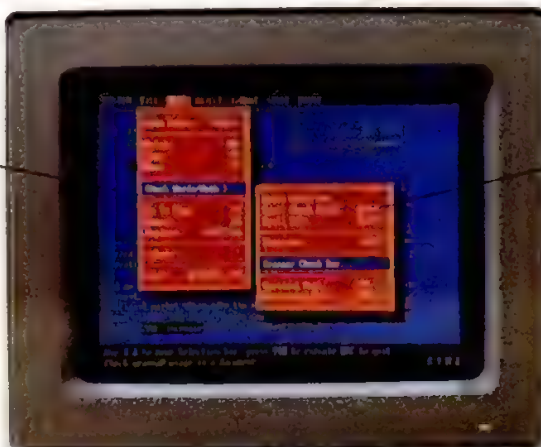


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```

IF Dial$ = "" THEN 'Prompt if a number is not specified
  INPUT "Enter Number to Dial ", Dial$
  IF Dial$ = "" THEN EXIT SUB
END IF

PRINT "*** Dialing "; Dial$ 'Dialing message
PRINT #1, DialCmd$: Dial$ 'Send dial command + number to modem

DO
  IF GetString$( "CONNECT", ExitCode) THEN EXIT DO 'exit on connect
  I% = I% + 1 'Increment number of tries
  IF ExitCode THEN 'If a key was hit, exit
    PRINT "Aborted Logon" 'with abort message
    EXIT SUB
  END IF
  LOOP WHILE I% < 10 'Loop until there are too many tries

IF I% = 10 THEN 'Tried too many times, exit
  PRINT "No answer"
  EXIT SUB
END IF

PRINT "Connected" 'Connection detected
PRINT "*** Logging On ***" 'Message
END IF

DO
  IF ExitCode THEN EXIT SUB 'do this until we receive a prompt
  ' or an exit code
  IF IOSTR$ = "" OR Password$ = "" THEN EXIT SUB 'Exit if no password/id set
  PRINT #1, CHR$(3); 'Print a "C" to port

  IF INKEY$ <> "" THEN PRINT "Aborted Logon": EXIT SUB

  OK = GetString$( ":", ExitCode)
  IF OK THEN
    PRINT "Sending ID"
    PRINT #1, IOSTR$
  END IF
  LOOP UNTIL OK

DO
  IF ExitCode THEN EXIT SUB 'Do until we receive a prompt
  ' or an exit code
  OK = GetString$( ":", ExitCode)
  IF OK THEN
    PRINT "Sending Password"
    PRINT #1, Password$
  END IF
  LOOP UNTIL OK

END SUB

SUB MakeCRCTable (CRCTable$()) STATIC
  FOR X% = 0 TO 255 'Assign CRC for each possible number
    CRCTable$(X%) = CUI(CRCCalc$(X%)) 'from 0-255 (8 bits)
  NEXT X%
END SUB

SUB XModemSub (CRCTable$()) STATIC
  CurrBlk% = 1 'Set current block to 1
  BlockOk% = 0 'Clear good block flag
  Timeout% = 10 'Set time out (20 sec. for relaxed)
  ErrCount% = 0 'Clear the error counter
  TBlock% = 133 'Total block size CRC
  Abort% = 0
  PRINT FileName$

  IF DirectFlag% = 0 THEN
    INPUT ">>> Enter file name to Receive > ", FileName$
    IF FileName$ = "" THEN EXIT SUB 'User just pressed Enter
  END IF

  OPEN FileName$ FOR OUTPUT AS #2 'Open the output file
  PRINT "*** Sending start character ***"
  PRINT #1, "C"; ' "C" requests CRC protocol

  DO
    IF ErrCount% > 14 THEN
      CALL AbortFile(FileName$)
      EXIT SUB 'Too many errors, exit
    END IF

    Buffer$ = SPACES(TBlock%) 'Pad buffer to TBlock% characters

    FOR Ptr = 1 TO LEN(Buffer$) 'Assume we fill the whole buffer
      T% = TIMER 'start a timer for timeout
      DO UNTIL LOC(1) 'Wait for a character to come in port
        IF INKEY$ = Quit% THEN Abort% = -1 'User requested abort
        'Short timeout for EOT
        IF LEFT$(Buffer$, 1) = EOT% AND TIMER > T% + 3 THEN EXIT FOR
        'short timeout to start
        IF CurBlk% = 1 AND TIMER > T% + 3 THEN EXIT FOR
        'If timed out, jump out of loop
        IF TIMER > T% + Timeout% THEN EXIT FOR
      LOOP
      'Put any characters into Buffer$
      MID$(Buffer$, Ptr, 1) = INPUT$(1, 1)
    NEXT

    IF INKEY$ = Quit% OR Abort% THEN 'User requesting abort
      CALL AbortFile(FileName$)
      EXIT SUB
    END IF

    CALL CheckBlock(Buffer$, Status$, Ptr$, CRCTable$())

    SELECT CASE Status$
      CASE 1
        IF BlockOk% THEN
          PRINT #2, MID$(Buffer$, 4, 120); 'the data block
          ErrCount% = 0 'Reset error count
          PRINT #1, ACK%; 'Signal "OK" to sender
          PRINT "Block "; CurBlk%, CurBlk% + 128; " Bytes" 'update user
          CurBlk% = CurBlk% + 1 'Bump block count
        ELSE
          CALL FlushBuf
          PRINT #1, NAK%
        END IF
      CASE 3
        CALL AbortFile(FileName$)
        EXIT DO 'File aborted
      CASE 4
        PRINT #1, ACK%; 'File received okay
        CLOSE #2 'Acknowledge end of file
        'close output file
      ELSE
        PRINT " *** End of transfer ***" 'say that we're done
        'How much we received
        PRINT ((CurBlk% - 1) * 128); " Bytes received"
        PRINT " File: "; FileName$; " saved" 'What was saved
        PRINT "Press Enter"
        PLAY "L1602ECG" 'Use BEEP with OS/2
        EXIT DO
      CASE ELSE
        LOOP SELECT
    END SELECT
  LOOP
END SUB

```

are a few potential pitfalls to avoid:

- Never press Ctrl-Break during a data transfer. Although you can usually recover from Ctrl-Break in the QuickBASIC editing environment, in a standalone program, your PC may lock up.

- When writing a program in QB, pay close attention to the disposition of incoming data. QuickBASIC maintains an input buffer to capture incoming characters from the modem, but it must be emptied periodically or it will overflow, and a "Communications buffer overflow" error is almost always fatal to the operation of a program.

When transferring data, the program must be able to keep up with characters as they are sent. In PCACCESS this is handled by the XmodemSub subroutine, which simply accepts each line of data and then writes it to the disk file. At 1,200 bps,

data is received at approximately 133 characters per second. With a default buffer size of 512 bytes, the program has about 2 seconds to unload the buffer. Depending on what a program you write is going to do with the data, the default receive buffer size may need to be increased. The communications buffer may optionally be increased by using the RB option of the OPEN COM statement. For PCACCESS, 512 bytes is sufficient because the Xmodem protocol sends blocks of only 133 characters at a time.

Timing does come into play in the file transfer subroutine, however. Once PCACCESS has agreed upon a protocol (in this case CRC Xmodem) with the sender, every few seconds the program will be receiving blocks of data 133 bytes in length. The remote terminal or network

waits for an acknowledgement signal from PCACCESS before sending the next block. However, if PCACCESS does not respond with either an acknowledgement or negative acknowledgement within a given amount of time, most networks will assume the block was lost and retransmit it, possibly causing a buffer overflow.

To keep PCACCESS as simple to operate as possible, the communications parameters, phone number, PC MagNet ID, and password are all hard-coded into the program's source text. The DialCmd\$ contains the command to initiate auto-dialing (ATDT for touch tone or ATDP for pulse), and Dial\$ is programmed with your local PC MagNet telephone number. If your particular modem uses different dialing commands, replace the ATDx portion with the appropriate commands. The

Utilities

two strings are transmitted to the modem by the BASIC statement

```
PRINT #1, DialCmd$; Dial$
```

Once the connection is made with PC MagNet, a Ctrl-C must be sent to initiate the prompts before you can actually log on. PCACCESS sends this automatically each time it successfully connects.

THE MAIN COMMUNICATIONS LOOP

Two important processes occur in the main communications loop. The keyboard is monitored for input from you with the `IS = INKEY$` statement, and the modem is monitored for data from PC MagNet with the `INPUT #1` statement. Each key you press is examined in the `SELECT CASE` statements to test for a possible PCACCESS command key, such as Alt-R or Alt-X. If the key is not recognized as a command key, then it is sent to the modem. The main loop also checks the modem for incoming characters. These are simply echoed to the screen as they are received.

The `FiltInp$` function filters the incoming text so that it will print correctly on the screen. QuickBASIC can print almost any character received from the modem, with the exception of the backspace and line feed characters. The backspace character, `CHR$(8)`, is converted to a `CHR$(29)` because that is what BASIC uses to move the cursor left one column position. The line feed character, `CHR$(10)`, is simply ignored. Without the filtering, the incoming text would be printed double spaced, possibly scrolling too quickly for you to read it easily.

DECODING XMODEM

When PCACCESS is ready to download a file using Xmodem, it calls upon the `XmodemSub` routine to do most of the actual work. PCACCESS uses a standard sequential format for writing files. When BASIC opens a file for sequential output, the file will be created if it doesn't exist, or overwritten if it does. Unlike BASIC's binary file operations (which can write only variables), sequential access allows PCACCESS to print any type of data, including the result of a function. Thus, for example, PCACCESS uses `MID$` to write a portion of a string to disk.

Once the output file has been success-

fully created, PCACCESS sends a "C", repeated 15 times at 3-second intervals, to PC MagNet. The "C" tells PC MagNet that PCACCESS is using the CRC protocol. Once PCACCESS and MagNet have agreed on this transfer protocol, PC MagNet begins sending blocks of data. After each block is sent, PC MagNet waits for a `CHR$(6)` Acknowledge character (ACK) to be sent from PCACCESS. If the block was not received successfully, perhaps because of telephone line noise, PC MagNet will send the data again automatically. PCACCESS times out after 10 seconds if it does not receive any data. In this case it sends a `CHR$(21)` Negative Acknowledge (NAK) character to PC MagNet.

**As PCACCESS
receives a block of data
successfully, it
displays the current
block number and the
total number of bytes
received.**

On heavily used systems such as PC MagNet and CompuServe, excessive activity by other users during peak periods can cause the network to slow down sufficiently to produce time-out errors while data is being transferred. If this happens often, you should change the time-out period in the Xmodem input loop to 15 or even 20 seconds. (Commercial communication programs call this extended time-out tolerance the "Relaxed Xmodem" protocol.) In extreme cases, save your money and simply call back later when the connection is likely to be better.

When PCACCESS receives a block of data, it checks the data for errors before writing it to disk. Each data block must be 133 bytes in length, and its first character must be either a `CHR$(1)` "Start of header" character (SOH), a `CHR$(4)` "End of transmission" (EOT), or a `CHR$(24)` "Cancel" (CAN). An EOT character signals that PC MagNet has finished sending, so PCACCESS should end the transfer. The CAN character tells PCACCESS that

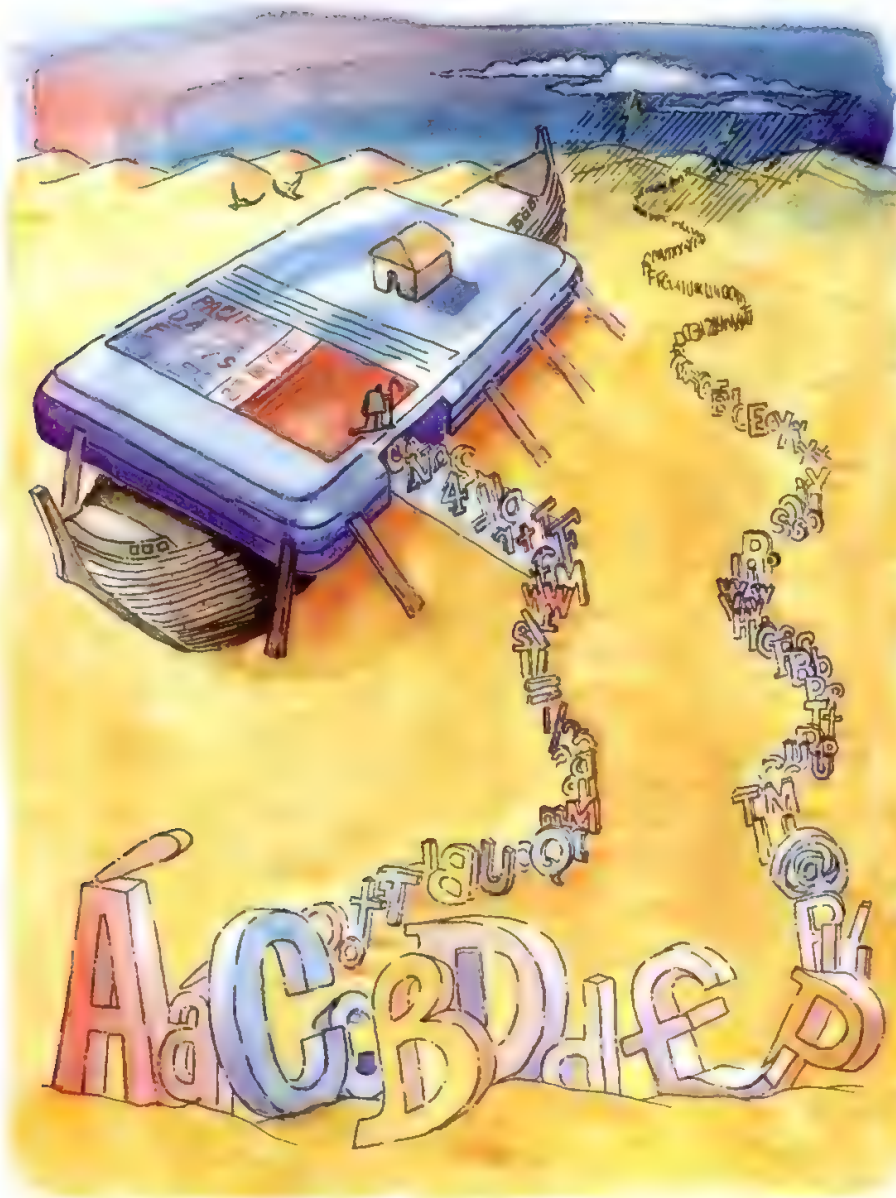
PC MagNet has cancelled the transmission. When PCACCESS receives either an EOT or a CAN signal, it closes the output file and exits the `XmodemSub` routine. If, due to errors, the received block is less than 133 characters or does not contain the EOT or CAN characters, the entire block is rejected and a NAK is transmitted to PC MagNet.

PCACCESS makes sure, then, that each block received is 133 bytes long and that the SOH character is the first byte. The second and third characters constitute the block sequence number. The sequence number must be checked against the current block expected by PCACCESS; this verifies that the transfer is synchronized. The two characters are also compared with each other to determine the integrity of the block number. In a more sophisticated system, additional logic would be added to cancel the transfer if the current block is out of sync. To keep the program as simple as possible, however, PCACCESS will refuse the block only if synchronizing errors persist.

PCACCESS uses a CRC-16 error-checking algorithm to calculate a CRC value for the data. As described more fully in the sidebar "How Xmodem Works," the CRC calculator takes the data, 1 byte at a time, and computes a 2-byte CRC checksum. The value that PCACCESS calculates is compared with the value transmitted as the last 2 bytes of the 133-byte block. PCACCESS will save the block and send an ACK character to PC MagNet only if the values agree.

The actual saving of the block is performed before the block has been acknowledged, for once PC MagNet receives the ACK character, it immediately begins sending the next block. Under some conditions—such as writing to a slow floppy disk drive—the delay could cause PC MagNet to assume that the block has been lost. In that case, PC MagNet would send it again.

To prevent the program from crashing, PCACCESS uses BASIC's `ON ERROR` statement to trap for "Disk full" and similar file errors. If an error occurs, the transmission will be cancelled and you must start again. As PCACCESS receives each block of data successfully, it displays the progress of the transfer on-screen by printing the current block number and the total number of bytes received. The PCACCESS Xmodem loop continues to request, check, and acknowledge blocks until the host sends an EOT character. When PC



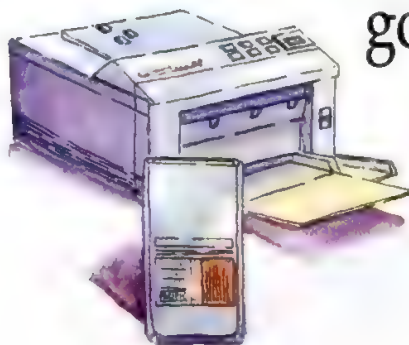
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Utilities

MagNet finally signals the end of the transfer, PCACCESS closes the file and then displays the total size of the received file.

PC MAGNET—THE ULTIMATE RESOURCE

A wealth of programs, information, and services await you on PC MagNet. Indeed, the many articles available through MagNet and other CompuServe forums were of enormous help in doing the research for writing the Xmodem routines contained in PCACCESS! While first-time users may feel overwhelmed at the sheer mass of options available through PC MagNet, by using the free practice forums, neophytes can quickly become experts. And whether you become a regular PC MagNet user or only download an occasional file, it will certainly enrich your computing diet. ■

Ethan Winer is a contributing editor of PC Magazine. Jay Munro, a programmer, writes utilities and other small programs for Crescent Software in Stamford, Connecticut.

EDITOR'S NOTE: Readers should be aware of a major new utility, PC MagComm, soon to be distributed free. PC MagComm is a communications package that allows PC MagNet users to easily access and navigate that on-line service. PC MagComm will not only perform the rudimentary functions provided by PCACCESS but will go far beyond it. PC MagComm has a point-and-shoot-menu interface and uses the CompuServe B+ protocol to download files quickly.

My primary motivation for having Ethan Winer and Jay Munro create PCACCESS is based not only on our desire to provide a simple means of obtaining PC Magazine's utilities, but also from the desire to show off the powerful features that QuickBASIC now possesses. All of you BASIC programmers out there still trapped in the ancient ruins of BASICA and GW-BASIC don't know what you are missing! True, these interpreters may be free, but the minor cost of moving up to a real language and compiler will pay back enormous dividends. If you come up with a great utility written in QuickBasic, TurboBasic or one of the other up-to-date versions of the language, submit it for consideration for publication in these pages. Think about it.—Tony Rizzo

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play with
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ASTRONOMY IS LOOKING UP

THE HIRSH REPORT OF THE SKIES VOL. 8, NO. 4, FALL 1990

Reported by The Star

Every day billions of dust particles enter in to Earth's atmosphere. Now scientists are working to make me-

ter-burst communication a practical and economical alternative to the use of tele-

(continued on page 2)

You Can't See the Great Wall from the Moon!

Everyone has heard that you can see the Great Wall of China from the Moon. Or from Earth orbit. Or even from Mars. Certainly you cannot see the Great Wall from the Moon. According to

an astronaut, it's difficult even seeing continents. You may be able to see the Great Wall from orbit, but, in general, it's difficult even to see familiar objects; the planet's swift mo-

(continued on page 3)

Voyager's Last Picture Show

When Voyager 2 was launched 12 years ago, who could have imagined these photos at this point in time.



More on planetary explosions inside.

NO BLACK HOLES?

Scientists are still unable to confirm the existence of even a single black hole, despite widespread belief that such things should exist. Tracking down these invisible objects isn't easy, because they can only be studied indirectly by the effects they have on their surroundings. There are several types of places that

(continued on page 3)

MIRROR, MIRROR

It's a chore, but all reflecting telescopes require cleaning their reflective mirrors. Eventually, the aluminum coating on their mirrors deteriorates and needs replacing. For large instruments, the process requires removing the tele-

(continued on page 6)

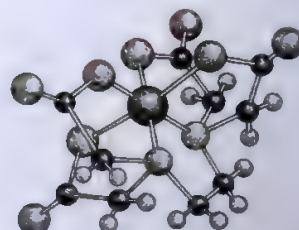
CHAIN REACTION

PAGE 15 CRITICAL LETTER

JUNE 9, 1990

VOLUME FOUR

ISSUE THREE



New Leaps in Metal-Organic Chemistry

Metal organic chemistry bridges the gap between organic and inorganic chemistry. It can lead to important new products (for example, poison antidotes). A chelate, such as EDTA above (containing carbon, hydrogen, oxygen and nitrogen atoms) can surround ions of metals and remove them from unwanted places. (continued next page)

What's New in Superconductivity?

It was almost exactly three years ago that a ceramic material that superconducts above liquid nitrogen temperature was discovered. Within days of the discovery, electronics, power transmission, and transportation were being redefined in everyone's imagination. Yet superconductivity was not a new phenomenon. The effect was first observed in mercury in 1911, and, since then, more than 6000 elements, alloys, and compounds have been found to superconduct! (continued next page)

Antimatter Bottled

A device tested may give investigators a glimpse of what an antimatter world might look like. The device cools antimatter to a temperature a few degrees above absolute zero and stores it for several days at a time. (continued next page)

Fifty Years Ago

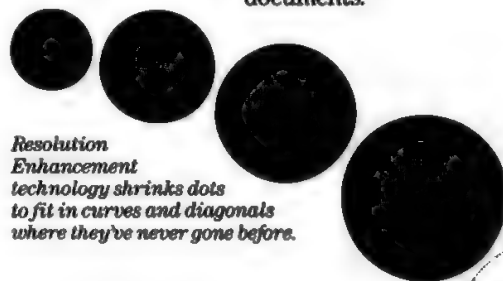
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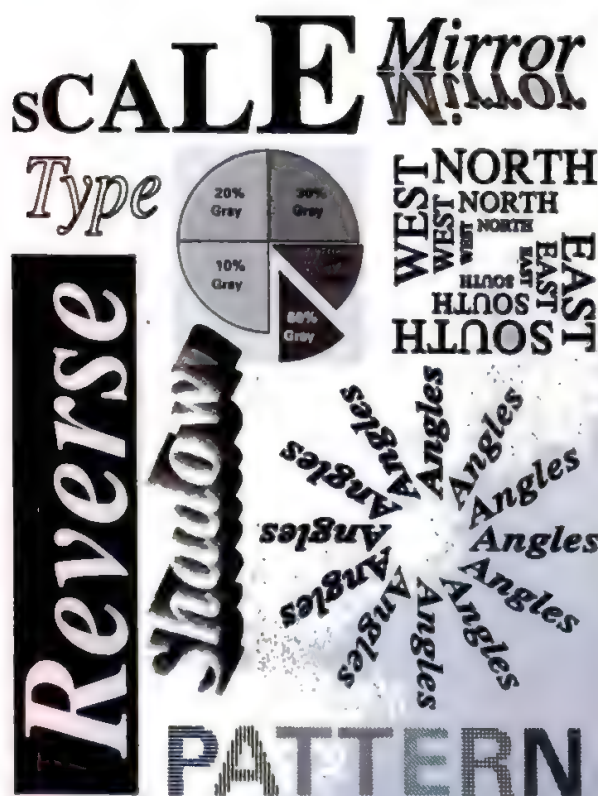
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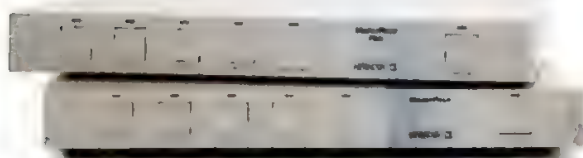
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by
Ray Duncan

Power Programming

Getting Acquainted with The Latest Version of OS/2: 1.2 (Part 2)

The pioneering OS/2 software developers have had a rough row to hoe. There have already been three major releases of the operating system in less than two years, and still another is due about the time this column is published. Each new version has required programmers to make drastic changes in their coding style to take full advantage of the system's capabilities. The jolts have probably been greatest for developers who learned their trade in DOS but managed to ignore *Windows*. Yet OS/2 has produced interesting challenges even for those with a Unix or Macintosh background.

Most OS/2 programmers probably thought the worst was over after they made the transition to Version 1.1 and the Presentation Manager (PM). Drastic restructuring was needed to make applications run cooperatively in an event-driven environment based on windows, menus, dialog boxes, and messages. That was the price developers had to pay to benefit from the PM's hardware-independent graphical user interface. Worse yet, programming tools that let PM applications be designed and implemented in a natural way weren't even part of the package. Instead, prospective programmers were handed a C compiler and a three-volume reference for some 900 OS/2 function calls.

OS/2 1.2 has now arrived, and it is evident once again that the days of marathon coding sessions followed by long nights of debugging are not over for that dedicated little band of OS/2 developers. The major changes in 1.2 affect the file system rather than graphics, but they are much more challenging than most of us expected. The system's new capabilities include file preallocation, multiple date and time stamps on files and directories, installable file systems, free-form filenames, extended attributes, and (if the network is running) extensive security mechanisms, peer servers, distributed name services, and automatic data replication. Overhauling applications to implement these capabilities properly will be no trivial matter.

■ The High Performance File System (HPFS) shows how multiple storage media with different controlling software can coexist on the same PC.

More important, OS/2 holds harbingers of upheavals yet to come. It is clear—from the characteristics, generality, and power of the extended attribute mechanism, for example—that Microsoft and IBM are rapidly laying the foundation for object-oriented file systems, user interfaces, and system-wide control of macro languages. At this point, when we ponder the mutations in the OS/2 API we can see only dimly what Microsoft and IBM plan for the future. But we can feel pretty confident that OS/2 will continue to be a moving target for at least several more years.

WHAT IS A FILE SYSTEM?

File systems are the central issue in OS/2 1.2. The phrase "file system" itself can be rather confusing, however, for it has two common but distinctly different meanings. When a physical storage medium is being discussed, the phrase refers to the manner in which data is formatted, organized, and indexed on the medium. The file system is the sum of the tables, directories, files, and other structures that allow data to be stored and retrieved by name. The file system also includes the ability to track and allo-

cate the remaining free space on the medium. The key point is that a physical file system, often called a "volume," is both self-consistent and self-sufficient.

When *file system* is used with respect to software, it refers to the module of the operating system that translates requests from an application program—to open, create, read, write, or close a directory or named file—into requests that the low-level disk device driver can understand. That is, the file-oriented, logical requests are transformed into one or more commands to the disk driver to read or write specific disk sectors. The software file system performs this translation with the aid of the tables, structures, and directories found in the physical file system.

So far, we're on pretty familiar ground. The OS/2 1.2 innovation is a powerful new concept called *installable file systems*. In OS/2 1.0 and 1.1 (and in nearly every other operating system in existence, for that matter), the software file system was embedded within the operating system kernel. The file system could not be modified or replaced without rebuilding the entire operating system. In OS/2 1.2, however, file-system code is logically segregated from the rest of the kernel code and is interfaced to the kernel through a dynamic link interface. Consequently, the file system can be altered or replaced as an isolated entity. Indeed, multiple, dissimilar file systems can be in use simultaneously!

As part of its support for installable file systems, OS/2 1.2 defines a new type of executable file, called an installable file system driver (FSD). An FSD resides on the disk in a file that is structured like a dy-

Power Programming

namics link library (DLL). It is in many ways analogous to a device driver. Typically, it has an .SYS or .IFS extension and is loaded during system initialization by IFS= statements in the CONFIG.SYS file. IFS= directives are processed in the order they are encountered and are sensitive to the order of DEVICE= statements for hardware device drivers. This lets you load a device driver for a nonstandard device, then load a file system driver from a volume on that device, and so on.

Once an FSD is installed and initialized, the kernel communicates with it in terms of logical requests for file opens, reads, writes, seeks, closes, and so on. The kernel remains oblivious to the physical layout and characteristics of the storage medium, just as a properly behaved application program does. As we would expect from our general understanding of a file system's responsibilities, the FSD translates the logical requests into requests for sector reads and writes, for which it can call special kernel entry points called File System Helpers (FsHlps). The kernel passes the demands for sector I/O to the appropriate device driver and returns the results to the FSD.

Not content with providing only a mechanism for installing new file systems, Microsoft and IBM went on to actually design and implement an installable file system, known as the High Performance File System (HPFS). The HPFS's cache strategies, lazy writes, means of data recovery, and use of sophisticated data structures such as B-trees and B+ trees will be discussed in future columns. For now, suffice it to say that the HPFS is a watershed in the evolution of microcomputer software. It represents both a new way of organizing a physical storage medium for maximum performance and a software file system that uses every trick in the book to minimize CPU demand while maximizing throughput.

The impact of OS/2's support for installable file systems on application programs is much more far-reaching than it might appear at first glance. The OS/2 application program interface (API) represents each file system as a single set of file manipulation capabilities. It does so in the form of the entry points for the functions DosOpen, DosChgFilePtr, DosRead, and so on. A particular file system is selected

by the application's explicit designation of a logical drive or by its default selection of the "current" drive. At this level, the OS/2 1.2 file system is a superset of the previous versions; all of the API functions from OS/2 1.0 and 1.1 are supported, some of the old calls have added functionality, and there are a variety of new function calls to learn.

Here's the rub. At any one time, a running OS/2 1.2 system can have two, three, or even more radically different types of physical file systems mounted, each controlled by a different software file system. For example, even at this early stage in the history of installable file systems, my ap-

plication might simultaneously be accessing files on FAT (file allocation table) diskettes, both FAT and HPFS disk partitions, a CD-ROM, and a LAN—each of which has a vastly different organization, directory structure, and naming and storage conventions and limitations. In such a situation, the same API function, called with the same parameters, may behave quite differently on different logical units.

DOSOPEN AND DATE/TIME STAMPS

From the very beginning, OS/2's DosOpen function (which is used both to open and to create files) has had a 32-bit param-

PC MAGAZINE OS/2 STANDARD EXTENDED ATTRIBUTES	
Standard Extended Attribute (SEA)	Definition
.TYPE	Indicates the file type; that is, the nature of the file's contents. The PM File Manager examines the .TYPE of a data file to determine which application should be launched to process the file.
.KEYPHRASES	One or more keywords or key phrases that describe the file's contents. This EA might be used by a disk browser or similar utility.
.SUBJECT	Intended to contain a brief abstract of the file's contents and purpose.
.COMMENTS	Miscellaneous notes about a file's contents or purpose.
.HISTORY	A multivalued EA in which each item contains a date, a person's name, and an indication of what was done to the file (creation, modification, printing, and so on).
.VERSION	Intended to contain a version number of the particular file format, which can be inspected by the application to determine whether it knows how to process the file.
.LONGNAME	Contains the original long name of a file that has been copied to a storage medium (such as a FAT volume) that cannot support the full name.
.CODEPAGE	Indicates the codepage that should be used to display the data contained in the file.
.ICON	Contains bitmap data that can be displayed as an icon by the PM Desktop Manager or File Manager.
.ASSOCTABLE	Indicates the file types (either by .TYPE EA or by filename extension) that are "owned" by an application program or can be processed by that application. May also contain default icon data for "owned" data files.
.APPTYPE	Indicates the application program type (PM, windowable, full-screen, or real-mode only).

Figure 1: The standard extended attributes (SEAs) are defined by Microsoft and IBM for communication between the PM shell, PM File Manager, other disk utility programs, and application programs. SEAs will eventually serve as the basis of an object-oriented file system and user interface.

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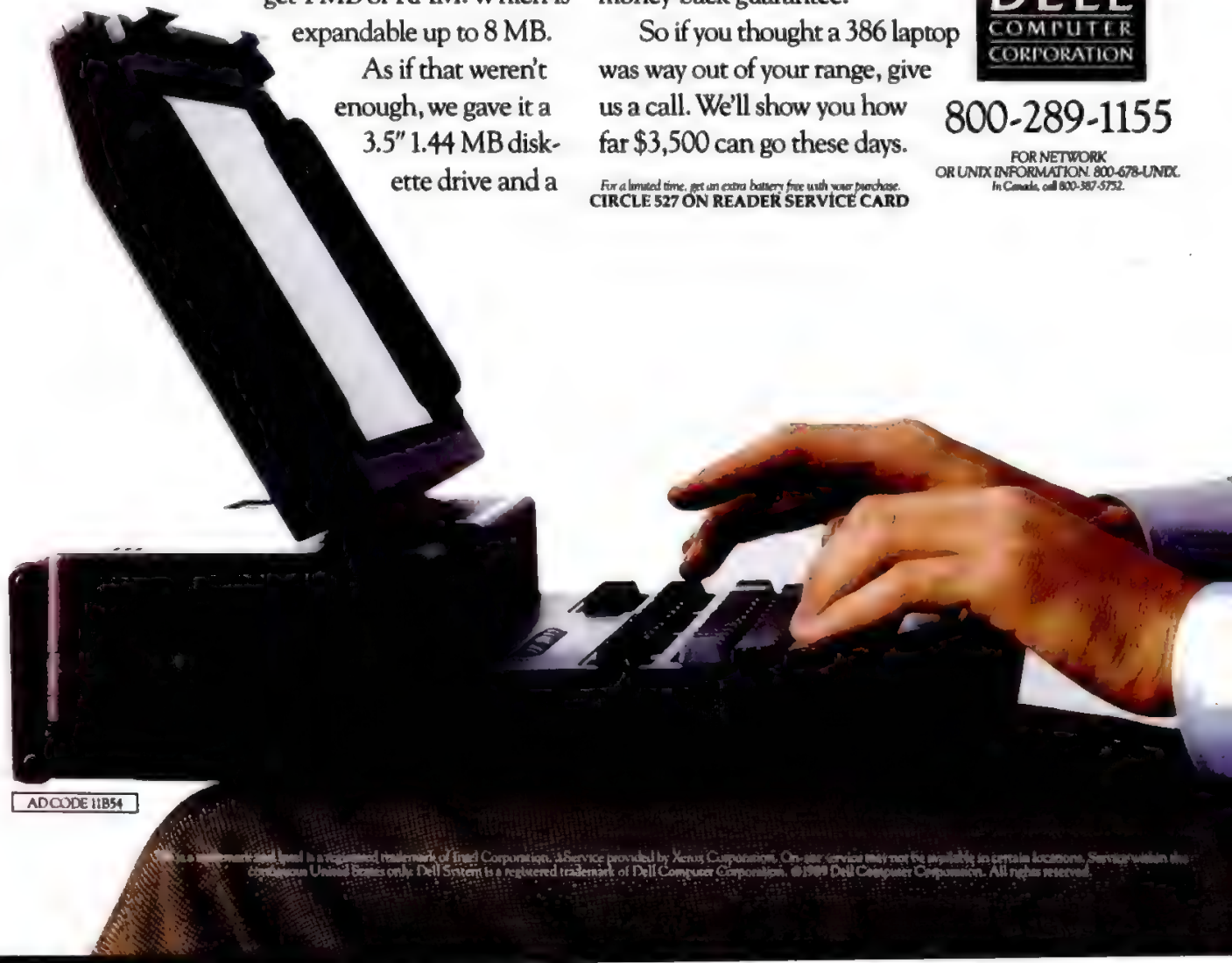
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Power Programming

eter specified as "initial file allocation." The intent of this parameter is to allow a program to reserve contiguous space for a file when creating it, assuming the program knows how much space the file will eventually need. It's a nice idea, and it could largely eliminate the need for disk defragmentation utilities.

In OS/2 1.0 and 1.1, which supported only FAT file systems, the space was indeed allocated, but there was no guarantee that it would be contiguous. Moreover, because there was no room in FAT directory entries to maintain the file preallocation and actual size separately, a program could peek at the contents of previously erased files. It would pull this trick off simply by preallocating a very large file and then reading in records that it had never written.

In OS/2 1.2's HPFS, the DosOpen preallocation parameter has finally become truly useful. First, the HPFS knows how to preallocate files so that they are maximally contiguous. It will search for a sufficiently large number of contiguous sectors; that failing, it will search for two strings of contiguous sectors that are half the size of the requested preallocation, and so on. Second, the HPFS can keep track of file size and file preallocation separately. It maintains a "high-water" mark for write operations to the file and returns zeros when a program attempts to read a record that has never been written.

Again, from the earliest versions, the OS/2 API has also allowed for three date-and-time stamps on each file: creation, last access, and last modification. Since FAT directories didn't have room for more than one date and time per file, however, only the date and time of the last modification were actually stored; the remaining capability went unused. The creation and last-access dates and times were undefined on a "get" function and were required to be 0 on a "set" function. Files stored in an HPFS, on the other hand, can make full use of the triple date-and-time stamp capability. Other storage media types (such as Unix) can also make use of all three dates and times.

LONG FILENAMES

OS/2 1.0 and 1.1 supported filenames only in the historic 8.3 format—eight characters for the filename and three characters for the extension, with the two compo-

nents separated by an implicit dot delimiter (the dots were not actually stored in the directory entries). This severely limited format was preserved for historical reasons and because the previous versions of OS/2 supported only the DOS-style FAT.

In OS/2 1.2, however, the traditional filename limitations found in DOS and earlier versions of the OS/2 environment have been removed. In general, the file API functions in OS/2 1.2 support long, free-form filenames with embedded spaces, mixed case, and multiple dot (.) delimiters. Because of the installable file system capability, however, naming limitations may vary from one logical drive to another. A FAT volume on an OS/2 1.2 system, for example, still has the same old 8.3 naming limitations, while an HPFS volume allows filenames up to 254 characters long. CD-ROM and Unix storage media may have restrictions that are altogether different.

An environment in which naming restrictions are not homogeneous across all storage volumes is going to present some interesting new problems for application developers. A truly friendly application program will have to take an unprecedented amount of responsibility as it screens and processes filenames entered by the user.

Imagine, for example, that the user, after entering data for a while, selects "Save As . . ." and specifies a 20-character name for storage on an HPFS volume. Naturally, the file-save operation is successful, and he continues with his work. After typing in a few more lines, however, he decides to save the file to a different volume, one that happens to be a FAT diskette. The name is now illegal, but what is the most appropriate response by the application?

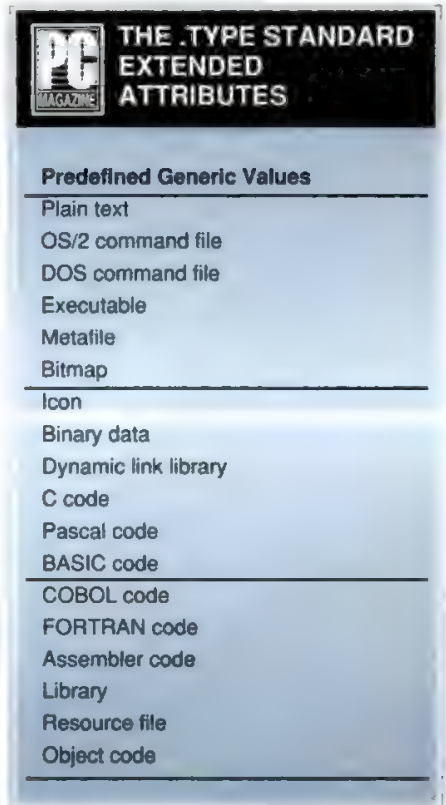
Bear in mind that most users won't have the vaguest notion of why the long name is valid on one volume and an error on another volume. Nor will they appreciate their file having two different names on different drives. Furthermore, they will probably insist that the original long name should still be kept around *somewhere*, just in case the file is eventually copied to yet another volume that can handle the full name.

EXTENDED ATTRIBUTES

In OS/2 1.2, file attributes are information about a file that is maintained by the operating system outside the file's storage area. This information is normally accessible by

applications with open, read, and write operations. The simple attributes supported in FAT file systems—and thus in OS/2 1.0 and 1.1 and in all versions of DOS—are very different; they have a lineage that goes back to Digital Research's CP/M operating system and before. These "attributes" are essentially bit flags, stored in each file's directory entry, that indicate whether the file is hidden, system, read-only, or archived. The DOS-style file attributes are inspected or modified by special function calls and are not accessible through the normal file open, read, and write calls.

For the sake of upward compatibility, OS/2 1.2 still supports the attributes of the FAT file system. But Version 1.2 *also* supports a new form of file-associated, highly generalized information called Extended Attributes (EAs). Each EA is conceptually similar to an environment vari-



Predefined Generic Values
Plain text
OS/2 command file
DOS command file
Executable
Metafile
Bitmap
Icon
Binary data
Dynamic link library
C code
Pascal code
BASIC code
COBOL code
FORTAN code
Assembly code
Library
Resource file
Object code

Figure 2: These generic values have been predefined by Microsoft and IBM for the .TYPE extended attribute. To avoid collisions with current or future generic .TYPEs, application-specific .TYPE values should also contain the names of the vendor and the application program; for example, "Microsoft Excel Chart." Inexplicably, Microsoft and IBM forgot to predefine the .TYPE value "Forth Source Code"!

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CIRCLE 145 ON READER SERVICE CARD

Power Programming

able. It takes the form

name=value

except that the value portion can be either a null-terminated (ASCIIZ) string, binary data, or both. Each file or directory can have as much as 64K of EAs attached to it—an upper limit that may be lifted still higher in a later release of OS/2.

The OS/2 kernel provides functions to query, add, and change the EAs associated with files or directories, but it does not inspect the contents of EAs or take any action on their "values." The interpretation of the names and values of EAs is thus strictly within the province of the system's shells, utilities, and application programs. In theory, software developers are free to use EAs in any manner and for any purpose they can dream up. To keep the EA situation from degenerating into total chaos, however, Microsoft and IBM have established a few simple EA guidelines.

EA names that begin with the characters ., \$, @, &, and + are reserved to the designers of the operating system. EA names beginning with a period (.) are known as "standard EAs" (SEAs), and a number of these have already been predefined for communication among the PM shell, PM File Manager, and applications. The names of the SEAs that either are documented in the preliminary OS/2 1.2 toolkit or are visible by poking around in the system appear in Figure 1. The names of application-specific EAs should be prefixed by the names of the software vendor and the application; for instance: MS EXCEL.WKSHT VERSION.

For data files, the most important SEAs are .TYPE and .ICON. These describe a file's contents and provide an icon for display by the File Manager, respectively. The use of .TYPE EAs is intended to replace the old convention of "typing" a file by its filename extension. It relieves the user of the responsibility for remembering the proper extension, allows him additional latitude in file naming, and eliminates the problem that arises when applications from different vendors use the same extension for files with different internal formats. Microsoft and IBM have predefined a fairly long list of generic .TYPE values, which are shown in Figure 2. Application-specific .TYPE values can also be used,

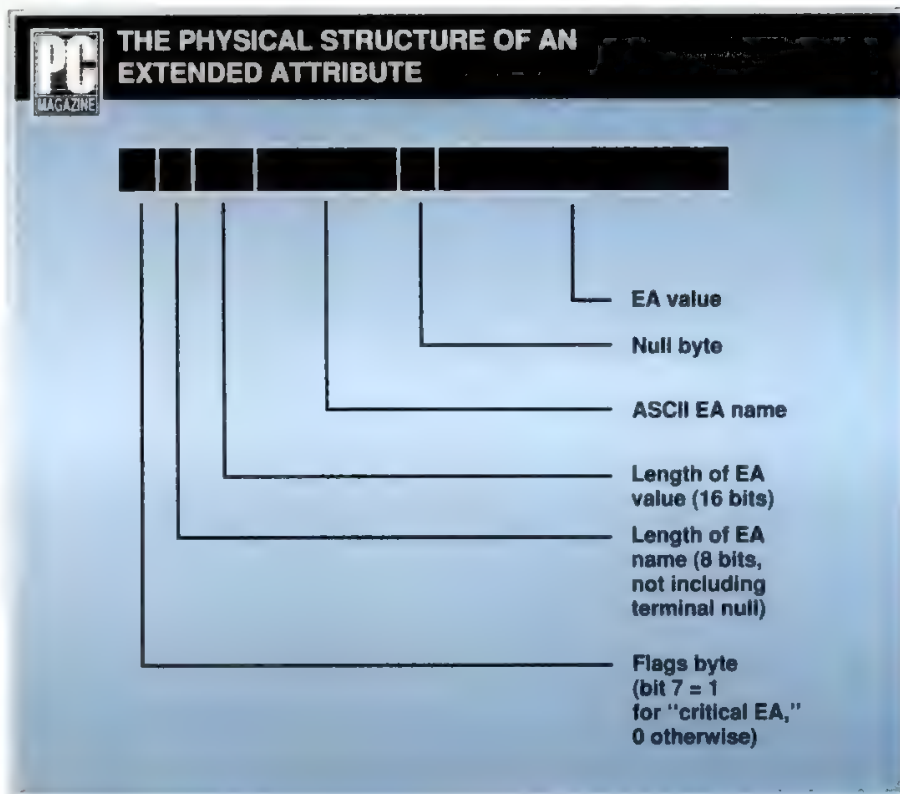


Figure 3: Only the first 4 bytes of an EA need be inspected by the kernel and file system when they are storing or retrieving EAs on behalf of an application program. Note also that case is significant in the EA name.

but these should be differentiated from the system's generic .TYPES by including the names of the software vendor and the program. For example, *Microsoft Excel* might assign .TYPE EAs to its data files using the values "Microsoft Excel Worksheet" or "Microsoft Excel Chart".

The other standard EAs (.HISTORY, .SUBJECT, .KEYPHRASES, and so on) are primarily intended for use by future file browsers and as documentation aids. The maintenance of standard EAs attached to data files is the responsibility of all application programs that create and access those files, but most of the standard EAs can be modified directly by the user with the aid of the File Manager's Properties dialog or with the EAUTIL utility.

For executable programs, the most important EAs are .ICON, .APPTYPE, and .ASSOCTABLE. The .ICON EA provides an icon for use by the PM Shell in the Program Starter menu when the program's window is minimized or when it is running in a background screen group. The .ICON EA overrides any icon data that might be present as a program "resource" or might be contained in a file with an .ICO extension. The .APPTYPE EA contains the same information found in the "applica-

tion type" field of the "new EXE" file header. That is, it indicates whether the program is a true PM app or windowable, nonwindowable full-screen, or real-mode only.

The .ASSOCTABLE EA is particularly interesting, because it provides the first glimmerings of Microsoft support for an object-oriented user interface. The .ASSOCTABLE EA is in the multi-item, multivalued EA class. It lists the .TYPE EA "values" and filename extensions for data files that the application "owns" and for other files that the application program does not "own" but knows how to process. This EA can also contain icon data for the "owned" data files. Unlike other EAs, the .ASSOCTABLE EA is defined by a series of statements in a resource source file, in much the same manner as dialog boxes, menus, and string tables. It is bound to the executable program by the resource compiler utility (RC.EXE).

Here's how the .ASSOCTABLE EA is used. Each time the PM shell accesses an executable file, it looks for the .ASSOCTABLE EA. If the EA is found, the information in the EA is added to a global table of executable programs, associated data file types, and data file icons that is stored

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a. Your Personal Information

Requested Line of Credit \$ _____

Your Name _____ Date of Birth _____
 First Initial Last Mo. Day Yr.

Present Address _____
 Street Apt. # City State Zip

Social Security Number _____ Home Phone _____

Date of Residence _____ Monthly Payment \$ _____
 Month Year □ Buy □ Rent □ Other

Previous Address _____

Dates of Residence _____
 From To

Your Employer _____
 (If self-employed, see rear panel.)

Date of Employment _____ Position _____
 Mo. Yr.

Monthly Income _____
 Gross \$ Net \$

Employer's Address _____
 Street

City _____ State _____ Zip _____ Business Phone _____

Previous Employer _____ Address _____

Dates of Employment _____
 From To

Other Income _____ I have received since (Date) _____
 Income from alimony, child support or separate maintenance payments need not be disclosed if you do not wish to have it considered as a basis for repaying this obligation.

Monthly Income _____
 Gross \$ Net \$

Name and Address of Nearest Relative Not Living With You _____

Relationship _____

b. Credit Information

Include joint information, if joint account requested.

Bank Account _____
 Bank Name □ Checking □ Savings

Address _____

Bank Account _____
 Bank Name □ Checking □ Savings

Address _____

Bank Loan Reference _____
 Bank Name Address

Payment _____ Balance _____

Bank Card Reference _____
 Bank Name Address

□ VISA □ Mastercard Payment _____ Balance _____

(please check appropriate box):

☐ **Joint Credit** with another person. Complete all information.

☐ **Individual Credit** but rely on income or assets of another person as a basis for repaying the credit requested. Complete all information

☐ **Individual Credit** Complete sections "a" and "b" only.

Please complete all appropriate sections, *providing at least two years' residence and employment history*. This will enable your information to be processed as quickly as possible. If you are self-employed, please be sure to complete section "d" below.

Other Credit Card Reference _____
 Bank Name Address

Payment _____ Balance _____

Other Credit References _____ Payment _____ Balance _____

Account No. _____ Expires _____

Driver's License No. _____ State _____ Expires _____

c. Joint Personal Information

Joint Name _____
 First Initial Last

Date of Birth _____ Social Security Number _____
 Mo. Day Yr.

Address _____
 Street Apt. #

City _____ State _____ Zip _____

Date of Residence _____ Home Phone (_____) _____
 Mo. Yr.

Employer _____

Date of Employment _____ Position _____
 Mo. Yr.

Monthly Income _____
 Gross \$ Net \$

Employer's Address _____
 Street

City _____ State _____ Zip _____ Business Phone _____

d. Self-Employed Information

Complete this section only if you are self employed.

Business Name _____

Business Address _____

□ Proprietorship □ Corporation □ Partnership Business Phone (_____) _____

Description of Business _____

Your Position _____ In Business Since _____

Your annual income from business _____ Business' annual income _____
 (gross) (net)

You must provide at least one of the following:

1. Business Bank _____

(_____) Telephone _____ Personal Banker's Name _____

2. Accountant's Name _____

(_____) Telephone _____

3. Financial statement on business attached.

(EXC. AK, & HI)

Power Programming

in OS2.INI. When the File Manager is invoked, it retrieves this table from OS2.INI and uses it in two ways.

First, the File Manager relies on the .ASSOCTABLE information collected in OS2.INI as part of its icon display strategy. In the case of a data file, the File Manager first looks for a .ICON EA attached directly to the file and uses that icon data if it exists. If the data file does not have its own .ICON EA, the File Manager then looks in OS2.INI to see if any application claiming to own the data file type has supplied an icon for that type. If the File Manager can't come up with an icon for the data file by either of these methods, it substitutes a "generic" data icon.

Second, the File Manager exploits the collected .ASSOCTABLE information to implement an "automatic application launch" facility similar to one found in the Macintosh Finder. If the user double-clicks on a data file's name or icon, the File Manager searches OS2.INI for the name of the first program claiming ownership of files with a matching .TYPE EA or—if the

data file doesn't have any EAs—a matching filename extension. If such a program is found, it is executed and passed the name of the data file. If no "owner" application program is identified, then the File Manager looks in OS2.INI for all programs that know how to process files with the same .TYPE EA or extension. The File Manager then presents the user with a list of these programs, leaving it to the user to choose one of the programs for execution or cancel the whole operation.

BINARY FORMAT OF EAs

While EAs are conceptually similar to environment strings, their physical representation is completely different. The fundamental structure of an EA is shown in Figure 3. It consists of a flags byte, the 8-bit length of the ASCIIZ name (not including the terminal null), the 16-bit length of the value, the ASCIIZ EA name itself, and lastly the EA value. At the current time, only bit 7 of the flags byte is significant; it is set (1) for a "critical EA" and cleared (0) otherwise. ("Old" applications are not allowed access to files with critical EAs; we'll discuss this issue in more detail next time.)

The EA value typically consists of a

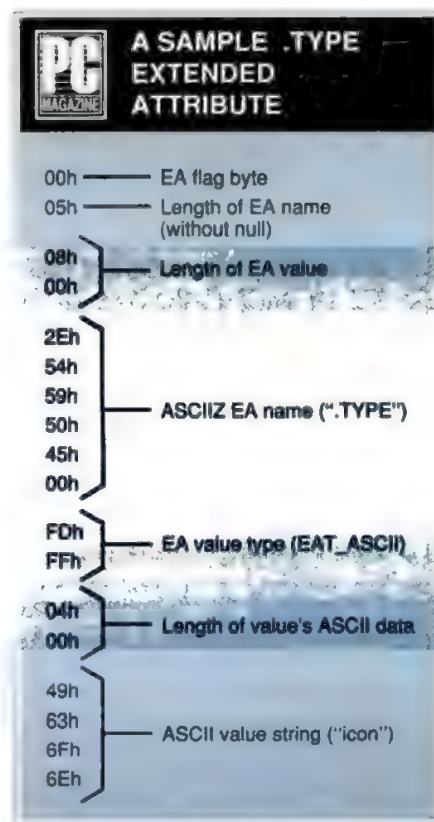


Figure 5: This is a single-valued, length-preceded, ASCII .TYPE EA that is attached by the Icon Editor utility to the icon bitmap files it creates and modifies.

TYPE INDICATORS FOR EXTENDED ATTRIBUTES		
Mnemonic	Binary type indicator	Significance
EAT_BINARY	FFFEH	Single-value, length-preceded binary
EAT_ASCII	FFFDH	Single-value, length-preceded ASCII
EAT_ASCII	FFFCH	Single-value, ASCIIZ string (null-terminated, no preceding length)
EAT_BITMAP	FFFBH	Single-value, length-preceded bitmap
EAT_METAFILE	FFFAH	Single-value, length-preceded metafile
EAT_ICON	FFF9H	Single-value, length-preceded icon
EAT_FN	FFFEH	Length-preceded ASCIIZ filename of associated data (equivalent to an #include statement)
EAT_EA	FFEEH	Length-preceded ASCIIZ extended attribute name of associated data (equivalent to an #include statement)
EAT_MVMT	FFDFH	Multivalued, multityped field
EAT_MVST	FFDEH	Multivalued, single-typed field
EAT_ASN1	FFDDH	ASN.1 field (ISO standard for describing multivalued data streams)

Figure 4: This list identifies predefined type indicators for the value portions of extended attributes. These value types are only conventions, but EA-aware programs should observe these conventions strictly so that it will be possible to write EA disk browsers, EA editors, and similar utilities. Type indicators in the range 8000H–FFFFH (not listed above) are reserved for future system use. Types 0–7FFFH are user definable.

number of fields. By convention, all EA values begin with a 16-bit type indicator as listed in Figure 4. For single-valued EAs, the type word is followed by a 16-bit length and then by the actual binary or ASCII data that is meaningful at the application program level. Naturally, multivalued EAs are considerably more complex, but they essentially use the formats of the single-valued EAs as building blocks. By way of illustration, Figure 5 shows the .TYPE EA that the Icon Editor attaches to .ICO files it creates or modifies.

In the next installment, I'll discuss the new API functions that allow inspecting or manipulating EAs, and I'll provide some guidelines for using EAs in your own application programs.

THE IN-BOX

Please send your questions, comments, and suggestions to me at any of the following e-mail addresses:

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by
Craig L. Stark

The Working Word

WHY WYSIWYG WON'T WORK UNDER WINDOWS

In last issue's column I concluded that the new *Microsoft Word for Windows*, while a corporate delight in terms of its many powerful features, is—in my judgment—not the correct choice for use by full-time writers. When editing or writing at my character-based screen, I regularly work for many hours at a stretch without discomfort. Similar concentration on the graphics-based text displayed on the *Word for Windows* screen resulted in clearly perceptible eyestrain in less than an hour, and an empty Tylenol bottle in less than a week.

The screen fonts I found so painfully hard to read are part of *Windows* rather than *Word*; we can hope for better things when the OS/2 Presentation Manager version of *Word* becomes available. In the meantime, however, since *Windows* is the dominant graphical PC user interface in use today, the defects of its screen fonts will affect the viability of all other word processors that rely on them.

This amounts to saying that we aren't yet ready to put graphically-based word processors into the PC workplace. Page layout programs are another matter: you don't create and edit large amounts of text in *Aldus's PageMaker* or *Ventura Publisher*, and you can format text without close reading. For real word processing, as long as we must use *Windows's* screen fonts, we must still say NYET (Not Yet Editable Text) to WYSIWYG.

That's not exactly a popular viewpoint in a world in which iconism is being preached with an almost religious fervor. In his October 17, 1989, *Environments*

■ WHY WYSIWYG WON'T WORK UNDER WINDOWS: Someday it may be practical to write and edit seriously at a graphics-based word processor, but not with today's screen fonts.

column, my good friend, Charles Petzold, put forth the pro-graphics position with characteristic clarity and vigor: "The fixed-pitch font is a typographical absurdity. It is both wasteful of space and more difficult to read than all but special-purpose proportional fonts . . . People who work mostly with text and numbers on their PCs . . . are precisely the people who should be embracing graphics most fervently . . . The distinction we often draw between text and graphics is essentially artificial. It arises from the (temporary) limitations imposed by primitive computer hardware."

By way of reply, I invite you simply to read the lines in Figure 1. Here, making use of *Word for Windows's* handy table-formatting capabilities, the same short phrase is displayed in 10- and 12-point sizes (left and right columns), in Times Roman (top), Helvetica (center), and Courier (bottom) typefaces, each in regular font.

Word for Windows uses 10-point Times Roman (the upper-left entry in Figure 1) as its default. Since that's the same typeface and size you're reading right now (we use it for the body copy in *PC Magazine*), one

kind of comparison is immediately possible. (The figure caption is in 8-point Helvetica.) For an additional readability comparison, simply type in the phrase in Figure 1 at the DOS prompt on your regular character-based screen. Now let's see whether your judgments about comparative readability match mine.

LOOKING CAREFULLY

Did you miss the colon at the end of the first sample in Figure 1? It's there, but you have to look very hard to spot it, and looking very hard takes both extra time and effort. (There's a missing *i* in the 12-point Helvetica sample, as well; it's impossible to miss it in character mode.) Again, notice how often your eye has to stop to disentangle closely spaced letters (*th*, *tr*, and so on) before you can be sure what the word is. Notice, too, in the first line, that the *a* looks too small and the *e* looks too large; neither looks anything like Times Roman. The doubled *s*'s are both too light in weight (they seem to disappear into the page) and their odd shape grotesquely resembles that of a Nazi insignia. The doubled *t* seems to float above the baseline, and there's a marked difference between the 10- and 12-point sizes (unbolded versions) in the spacing between the second *e* and the *w* in *committeework*.

I would suggest that within Figure 1, the monospace Courier fonts are the most easily read of the typefaces, with 12-point Helvetica next. Even the Courier fonts are badly formed: would you really *buy* a terminal whose fonts used *m*'s so misshaped that they became globs when bolded?

As you compare the samples in Figure 1

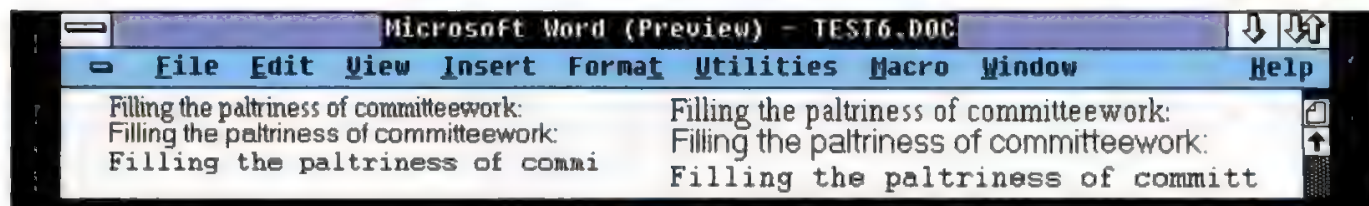


Figure 1: Compare these *Windows* screen fonts (10- and 12-point Times Roman, Helvetica, and Courier, respectively) with the printing in the magazine (10-point Times Roman body copy) and the character mode your screen normally produces. This caption is 8-point Helvetica.

The Working Word

both against your own screen and against the magazine, you'll find plenty of other detailed flaws as well. But at this point the WYSIWYG defender is likely to object that we're expecting too much from our "primitive computer hardware." After all, the magazine is printed with a resolution of approximately 2,000 dots per inch; a laser printer has a resolution of 300 (sometimes 400 or 600) dots per inch; and the screen of a VGA has a resolution of only 68 dots per inch.

Petzold's quite right, of course. By some standards a VGA monitor is primitive. But relatively few people who have to use word processors to get work out today are likely to have anything more sophisticated. Yet *he's* the one telling us that we should be "fervently embracing" the graphics-based treatment of on-screen text! It is absolutely *essential* to word processing that letters *not* call attention to themselves, or you're faced with the same problem in reading that a beginning typist is when he has to think where the letters are on his keyboard. You and I have no trouble reading the regular character-based fonts on our screens without so much as a second glance; can you say that of the graphics-based *Windows* fonts? Which, then, is the "typographical absurdity?"

ERSATZ TIMES ROMAN

Apart from the details, two things are very obvious from even a quick glance at the samples in Figure 1. First, the fonts have a gossamer look that detracts not only from readability in general, but from resemblance to Times Roman in particular. Second, the Helvetica typeface is easier to read in the samples than is the Times Roman. Let's see why these things are so, starting with a couple of general points.

Most business correspondence and writing today is done in nominal 10-point or 12-point type sizes. In monospace terms, these correspond roughly to Elite and Pica typewriter designations, respectively. Microsoft assumes that for most purposes a 6-inch line of type (1.25-inch left and right margins) is about right. That's 60 characters in Pica monospace and 72 characters in Elite. (The remaining width—ten percent—of a standard 80-character DOS screen is occupied by graphical-interface appurtenances.)

Of course, you get many more charac-

ters in a 6-inch line of proportional type than you do with a monospace font. Microsoft's "Dear Reviewer" letter uses 10-point Times Roman and seems to average about 95 characters per 6-inch line. That's the obvious advantage of graphics-based screen fonts. Now let's see why they cost so much in readability.

Figure 2 shows the ordinary, character-mode letter F, brought up in Michael Meford's FONTEDIT utility (*PC Magazine*, September 13, 1988). Figure 3 shows the same letter from a *Windows* 10-point Times Roman screen font, using Soft-Craft's *Font Editor*. (Regrettably, *Windows* does not have a font editor for modifying its supplied screen fonts, but many of the Bitstream-based font-generating programs produce similar screen fonts for *Windows* that you can edit. I do not believe there is any discrepancy between the true Microsoft *F* of Figure 1 and the Bitstream-generated equivalent shown here.)

The immediately obvious fact is that the main vertical lines of the *Windows* screen fonts are only one pixel wide. By contrast, the vertical lines in the letters in native DOS character-mode screen fonts are generally two pixels wide. That makes the DOS fonts a lot easier to read—they're halfway between normal and bold versions of the *Windows* screen fonts.

Moreover, if you look at the Times Roman *F* (and letters like *T*, *I*, *H*, and *P*) here in the magazine, and compare the vertical lines against the *N*, the left side of the *M*, and so on, you'll see that real Times Roman often *requires* a heavy, not a thread-like, vertical line to establish the letter.

The *Windows* Times Roman screen

fonts for 14-point (and larger) type sizes *do* have much more realistic thick-to-thin lines in their fonts. But at that point, of course, you've reached a type size where you can't put any more characters (on average) on a line than you could with the plain-old DOS character mode. And, of course, 14-point Times Roman would be unsuitably large for a business letter.

Evidently, however, to maintain the overall width ratios between a *W* and an *i* and still put 6 inches' worth of proportionally spaced 10-point Times Roman letters on the screen, Microsoft's font designers decided they had to build the 10- and 12-point type sizes on 1-pixel vertical lines throughout. Since the lines and curves that constitute letters on the screen must obviously be created with whole numbers of pixels, if you start with heavy verticals of only one-pixel width, you have already lost the opportunity to create light-to-heavy variations. Thus, even if you *could* read the results without eyestrain, *Windows* precludes (in its 10- and 12-point sizes) the thickness variations that are an essential part of what makes Times Roman a desirable typeface in the first place.

HELVETICA IS EASIER

It's no accident that Helvetica (or something like it) is the font of choice for those who want graphics-based text. For one thing, it has no serifs—and if you compare the 10- and 12-point Times Roman *l*'s and *i*'s in Figure 1, you'll see the problems they can present. For another thing, while Helvetica is proportionally spaced, it does not have such wide thick/thin variations within individual letters. It's thus easier to



Figure 2: Character-based screen fonts are designed around 2-pixel-wide vertical lines.

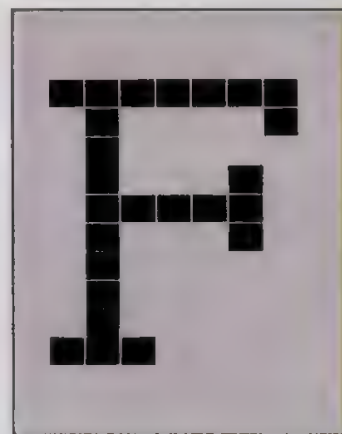


Figure 3: At 10- and 12-point sizes, the *Windows* fonts are built on 1-pixel-wide lines.

The Working Word

make a consistent-looking font, whose letters all seem to "weigh" about the same, from a very limited supply of pixels. But unless you send all your business letters to laid-back Mac users, Helvetica isn't likely to convey the tone you want.

THE CORPORATE FIAT

What if your boss says you *must* use a *Windows*-based word processor? After making an appointment with your optometrist, you can *try* to make a legible font by using a font editor to hand-edit screen fonts generated from the font outlines you use to make your printer's soft fonts.

That's a *lot* of work, for you must *first* clean up the rounding errors (obviously missing or extraneous pixels) that arise when generating the tiny fonts used to match today's screen resolutions. (In terms of pixels, a 12-point printer font is approximately equivalent to a 4-point screen font.) You'll have to do this much in any case for typefaces—such as Palatino—for which *Windows* supplies no internal support.

Then, unless someone comes up with better screen fonts than *Windows* supplies, you have to redesign your own Times Roman typeface layout—probably using a 2-pixel base for the heavy verticals. Wasn't WYSIWYG supposed to make our jobs easier?

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Word for Windows should lead to a wealth of reader tips. I'm particularly interested in hearing about your use of fields, as well as the use of DDE links.

TIPS FROM WORKING WORDSMITHS

Tell fellow users about your latest word processing tips, and we'll pay you \$50 for any tips we print. Please send your letter on a disk along with a printout. Mail your contributions to The Working Word, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see the "By Modem" sidebar in the Utilities column).

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CIRCLE 540 ON READER SERVICE CARD

by
Neil J. Rubenking

User-to-User

HOW MANY BYTES FREE?

Taking a DIRectory of an empty floppy disk normally gives you nothing but a "File not found" message. With my patch added to COMMAND.COM, it gives a much more useful report, like this one:

```
0 File(s)    309248 bytes free
```

If only 309,248 bytes are free, there must be something on the seemingly empty disk. That something could be either bad sectors or hidden files—most likely the BIOS and DOS files.

This patch applies to DOS 3.3 COMMAND.COM, dated as follows:

```
COMMAND.COM 25307 3-17-87 12:00p
```

Make sure you have a good boot disk in case anything goes wrong, as your computer probably won't boot with a mispatched COMMAND.COM. Use the command DEBUG COMMAND.COM, and at the - prompt enter U 277E L 01B. Figure 1 lists the unassembled code that you should see. The xxxx represents four hex digits that will be different on different systems. If your COMMAND.COM looks like the one listed in Figure 1, then assemble a patch. For example,

```
-A2796
xxxx:2796 NOP
xxxx:2797 NOP
xxxx:2798 NOP
xxxx:2799 <enter>
```

A PART OF COMMAND.COM UNASSEMBLED

```
BA6537      MOV     DX,3765
E8D023      CALL    4B54
B412        MOV     AH,12
BA5500      MOV     DX,0055
CD21        INT     21
E927FF      JMP     26B5
F706B942FFFF TEST     WORD PTR [42B9],FFFF
7503        JNZ     2799
E9AFFE      JMP     2648
```

Figure 1: COMMAND.COM can be patched so that it will *always* report the number of free bytes on a disk, even if there are no files to be displayed.

- **HOW MANY BYTES FREE?:** Patch DOS 3.3's COMMAND.COM to show you how much space is left on any floppy disk.
- **BASIC SECURITY:** This short BASIC program will wipe out sensitive file data much more easily than DEBUG.
- **MORE SPEED, LESS SPACE:** Save disk space with a double-duty AUTOEXEC.BAT.
- **REPEATING COMMANDS:** It's not easy to execute a DOS command on a list of files.
- **OFF BY ONE:** A missing byte is restored to CURSOR.COM.

Use the W command to Write out the patched COMMAND.COM. DEBUG should echo "Writing 62DB bytes". Enter Q to Quit DEBUG.

At this time you should reboot, since the COMMAND.COM that appears on your floppy disk won't match the one in memory, and this may result in an "Invalid COM-

MAND.COM" message until the two files are "synchronized" by rebooting with the new COMMAND.COM.

Ward Christensen
Dolton, Illinois



Any time you patch COMMAND.COM, you should make sure you have a way to boot from a floppy disk if your patch goes awry. Format a floppy disk with the /S parameter and copy COMMAND.COM to it. Now check your CONFIG.SYS—are there any device drivers that manage your disk subsystems? Common examples are drivers for partitioning hard disks and drivers for removable storage devices such as Bernoulli cartridges. If your system requires these, copy the drivers to the boot disk and create a CONFIG.SYS that loads them. Test your work by rebooting with the bootable floppy disk in A:. Now you can safely meddle with COMMAND.COM, knowing that if you make a mistake, you can boot from a floppy disk *and* still access all of your other disks.

When the unpatched COMMAND.COM finishes listing the files in a directory, it checks the number of files displayed. If there are none, the JMP instruction at offset 2796 jumps over the code that lists the number of bytes free on the disk. Our patch simply eliminates that JMP, so the patched COMMAND.COM *always* reports the number of free bytes.

This is a patch for PC-DOS 3.3 COMMAND.COM, no other. You can apply it to PC-DOS 3.0, 3.1, and 3.2 with the following changes:

Version	U	A
3.2	2410	2428
3.1	2224	223C
3.0	2035	204D

Use the number in the U column for the initial Unassemble command, replacing 277E. When you execute that command, the result should be *similar* to the disassembly above—the assembler commands

User-to-User

will be the same, but the addresses will be different. Use the number in the A column for the Assemble command, replacing 2796. Write the changed file (which will not be 62DB bytes in size) and Quit. Reboot to make the patched COMMAND.COM active and you're done.

BASIC SECURITY

I enjoyed your article on completely deleting sensitive files using DEBUG (User-to-User, April 25, 1989). But using DEBUG for this purpose is rather complicated, and one must proceed very carefully, step by step.

KILLER.BAS (Figure 2) is a fairly simple BASIC program that does the whole thing by itself, with no input from the computer operator other than the filename. It seems to work every time. Try it!

Stanley J. Goldstein

Westwood, New Jersey



Indeed, it is a painstaking task to wipe out a file's data using DEBUG. Everyone should do it once for the experience, but if you need to wipe out sensitive files often, it's tedious to do so by hand. This BASIC program does the job. If you unerase a file processed by KILLER, you'll find that it consists of nothing but ASCII 00s. It will be slightly larger than the original, because KILLER.BAS overwrites the file with 128-byte blocks.

The BASIC program requires the user to type in the filename, confirm the deletion, and press a key. Thus, it's not practical for wiping out a series of files within a batch file. I created the slimmed-down version shown in Figure 3; this does *only* the file wiping. It assumes that the filename to be wiped exists and that it is in the environment variable VICTIM. Figure 4, KILLER.BAT, demonstrates how you might use KILLER2.BAS.

MORE SPEED, LESS SPACE

Recently you printed a tip for speeding up AUTOEXEC.BAT by having it copy a second batch file to the RAMdisk and execute that file from the RAMdisk. I use a similar technique on my two-floppy system, but without the inconvenience of the second file. I also save another cluster of precious disk space on my boot floppy.

AUTOEXEC, like any other .BAT file, can be executed with replaceable param-

KILLER.BAS

COMPLETE LISTING

```
100 DEFINT A-Z
110 ON ERROR GOTO 330
120 CLS:KEY OFF:COLOR 15,0
130 CLS:LOCATE 12,24:LINE INPUT"ENTER FILESPEC TO OBLITERATE ";
    FILESPEC$
140 OPEN"I",1,FILESPEC$:CLOSE      'Check to see that file exists
150 OPEN"R",1,FILESPEC$,128
160 SZ=INT(LOF(1)/128)+1
170 LOCATE 14,24:PRINT"ARE YOU SURE YOU WANT TO DO THIS? (Y/N) ";
180 A$=INKEY$:IF A$="" THEN 180
190 IF A$="Y" OR A$="y" THEN 220
200 IF A$="N" OR A$="n" THEN CLOSE:FILESPEC$="":GOTO 130
210 GOTO 180
220 LOCATE 14,64:PRINT "Y";
230 FIELD# 1,128 AS ZERO$
240 LSET ZERO$=STRING$(128,5)
250 FOR RN=SZ TO 1 STEP -1
260   PUT 1,RN
270   LOCATE 16,39:PRINT USING"###";RN;
280 NEXT RN
290 CLOSE :KILL FILESPEC$
300 LOCATE 18,33:PRINT "PRESS A KEY TO CONTINUE";
310 A$=INKEY$:IF A$="" THEN 310
320 LOCATE 20,42:PRINT"END":SYSTEM
330 IF ERL=140 AND ERR=53 THEN BEEP:BEEP:LOCATE 12,53:PRINT"file not
    found":FILESPEC$="":FOR X=1 TO 6000:NEXT X:RESUME 130
340 CLS:ON ERROR GOTO 0
```



Figure 2: Run KILLER.BAS under BASICA to totally wipe a file's data from the disk.

KILLER2.BAS

COMPLETE LISTING

```
100 DEFINT A-Z
110 FILESPEC$=ENVIRON$("VICTIM")
120 PRINT "Obliterating ";FILESPEC$
130 OPEN"R",1,FILESPEC$,128
140 SZ=INT(LOF(1)/128)+1
150 FIELD# 1,128 AS ZERO$
160 LSET ZERO$=STRING$(128,0)
170 FOR RN=SZ TO 1 STEP -1
180   PUT 1,RN
190   LOCATE 2,1:PRINT USING"###";RN;
200 NEXT RN
210 CLOSE :KILL FILESPEC$
220 SYSTEM
```



Figure 3: A slimmed-down version of KILLER.BAS (Figure 2) that is suitable for running from a batch file. It wipes out the file whose name is in the environment variable VICTIM.

KILLER.BAT

COMPLETE LISTING

```
@ECHO OFF
IF "%1"==" " GOTO noparam
IF NOT EXIST %1 GOTO nofile
SET victim=%1
IF NOT "%victim%"=="%1" GOTO noenvir
ECHO Press ^C if you do NOT want to permanently wipe out the
ECHO data in the file "%1". Otherwise . . .
PAUSE
BASICA KILLER2
ECHO . . .
ECHO File "%1" has been obliterated
SET victim=
GOTO end
:noparam
ECHO Syntax: "KILLER filename"
GOTO end
:nofile
ECHO File "%1" not found
GOTO end
:noenvir
ECHO Not enough environment space to run this batch file
:end
```



Figure 4: This batch file demonstrates how to use KILLER2.BAS to wipe out a file.

She's 5 years old. She's already had 7 names, 16 identities and 21 homes.

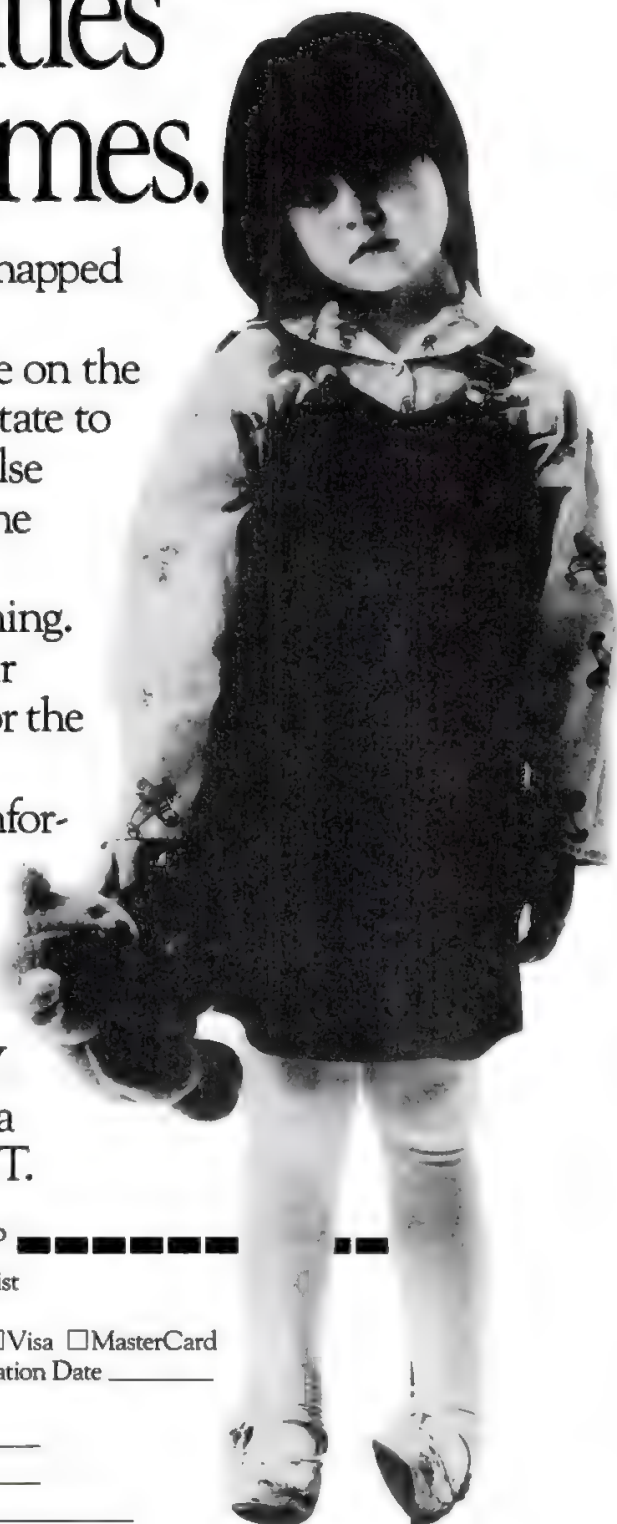
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19. *Chlorophyll *a* and *b* content* was determined by the method of Arar and *et al.* (1996). The optical density of the chlorophyll *a* and *b* was measured at 663 nm and 646 nm, respectively. The concentration of chlorophyll *a* and *b* was calculated using the following equations:



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Recently, Dr. Pournelle looked at Northgate's 80386 Pipeline Page Mode system and reported in BYTE July, 1989 (excerpted):

*Jerry Pournelle holds a doctorate in psychology and is a writer who also earns a comfortable living writing about computers present and future.



"... the case is sturdy, and the motherboard construction is clean and neat. The boards are thick; I've seen some clones with boards so thin they wave in the breeze."

"... I like this machine a lot."

"... The workmanship is superior."

"... there sure wasn't any installation required for this system. I just turned it on, and it came up in MS-DOS 4.01."

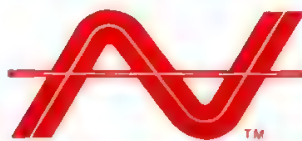
[a software program] ... "which is all graphics is almost twice as fast on the Northgate 80386 as on my other machines. So is Windows ..."

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User-to-User

ters. To take advantage of this, I set up my AUTOEXEC.BAT file to copy *itself* to the RAMdisk and run itself with a parameter that causes it to branch past the code it has already executed.

The start of the batch file looks like this:

```
IF NOT '%1'=='' GOTO again
RAMDISK C: /M=100
COPY AUTOEXEC.BAT C:
C:\AUTOEXEC X
:again
(the rest of AUTOEXEC goes here)
```

The first time through, there's no command-line parameter, so it doesn't branch on the first line. It executes the second and third lines, which create the RAMdisk and copy the AUTOEXEC to it. Next, it transfers control to the copy of AUTOEXEC.BAT on the RAMdisk, calling it with the command-line parameter X.

Because a command-line parameter exists now, this second execution jumps to the label *again*, bypassing lines 2 through 4. The rest of the AUTOEXEC executes quickly from the RAMdisk.

Malcolm McLean
Scarborough, Ontario
Canada



Using one multipurpose AUTOEXEC is definitely an improvement. To really refine the process, let's make the AUTOEXEC on the RAMdisk delete itself after executing. There's no point in keeping it around.

Naturally the DEL command should be in the very last line of the batch file. You'll want to specify the full pathname of the RAMdisk copy of AUTOEXEC, so as not to risk deleting the copy on the hard disk. But if DOS goes to fetch the next line of a batch file and the batch file is gone, it complains with the message "Insert disk with batch file and press any key when ready". To avoid this situation, make sure that there really is no next line. Do not hit <Enter> after the final T in AUTOEXEC.BAT; just save the file and quit. Now your AUTOEXEC can safely delete itself, leaving a pristine RAMdisk for your other applications to use.

REPEATING COMMANDS

I have a problem that seems simple, but it's been bothering me for some time now.

What I want to do is use the DOS input redirection character < to delete the files whose names are listed in a file called, for instance, BAKS.LST. I've tried to do this using the command DEL <BAKS.LST.

Nowhere in any DOS manual I have are DEL and ERASE excluded from input redirection. Am I missing something, or should I be using another command to do this?

John Overstreet
Sugar Land, Texas



There are two ways to pass information to DOS commands: keyboard input and command-line arguments. DEL uses both, but for very different purposes. You specify which files to delete using a single command-line argument—DEL *.BAK, for example. If you choose to delete all files in a directory, DOS will ask "Are you sure? (Y/N)" and wait for your response from the keyboard. It's possible to redirect this keyboard input with a command such as

```
ECHO Y | DEL *.*
```

But redirection can't affect *what* gets deleted—that's completely controlled by the command-line argument.

There really is no way to use a list of files in place of the command-line argument to a DOS command. But a BASIC program to read a list of filenames and delete them takes just a few lines of code, as shown in Figure 5. This tiny BASIC program does no error checking; it assumes that all of the files in your list exist.

There is another way to delete a list of files. Start by copying the list to a file named TEMP.BAT. Now load that file into your favorite editor and use the editor's find/replace feature to put "DEL " at the beginning of every line. Different editors will require different commands, but what you're trying to do is *find* an end-of-line and *replace* it with an end-of-line plus "DEL ". After making the replacement, you'll probably have to add the "DEL " to the first line by hand and delete the last line. Now just run TEMP.BAT to delete the list of files. Of course, you can use the same technique to perform other repeated actions, and you can add to the *end* of every line as well as the beginning.

Suppose TEMP.BAT contains a list of files to be copied to drive A:. Let CR/LF symbolize the end of the line—then *finding* CR/LF and replacing it with "A:<CR/LF>COPY " will turn your list into a batch file that does the job.

DELFILE.BAS COMPLETE LISTING

```
10 LINE INPUT "Filename with list
   of files to delete: ";DELFILES$
20 OPEN DELFILES$ FOR INPUT AS #1
30 IF EOF(1) THEN SYSTEM
40 LINE INPUT #1,YOUFILES$
50 PRINT "Deleting ",YOUFILES$
60 KILL YOUFILES$
70 GOTO 30
```

Figure 5: This BASIC program is one way to delete all files contained in a list.



OFF BY ONE

A common programming blunder is the "off by one" error. A program counts from zero when it should count from one, or uses numbers "less than ten" instead of "ten or less." In User-to-User in the November 28, 1989, issue, I introduced an off-by-one error that turns CURSOR.COM into trouble. The file is 0Ah bytes long, not 09h, so the final byte gets omitted when you save the file. This byte should be 20h—calling interrupt 20h is a standard way to end a program. With that byte missing, there's no telling what interrupt CURSOR.COM will call when it ends. Figure 6 is a corrected CURSOR.SCR. I also changed the resulting

CURSOR.SCR COMPLETE LISTING

```
A 100
MOV AH,01
MOV CH,0B
MOV CL,0C
INT 10
INT 20

RCX
A
N CURSOR.COM
W
Q
```



Figure 6: A corrected DEBUG script for CURSOR.COM, which restores the monochrome cursor.

cursor shape just slightly—the previous version put the cursor on the two bottom scan lines, but the actual default is one line higher.

SHARE YOUR SECRETS

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edited by
Tony Rizzo

Languages

MOUSE SUPPORT FOR BRIEF

I enjoyed the recent First Looks review of the OS/2 version of the *Brief* for OS/2 editor (*PC Magazine*, October 31, 1989, p. 44). I too wish that it supported a mouse. Other *Brief* users may be interested to note that it is indeed possible to bring mouse support to *Brief* simply by using Logitech's pop-up menu to superimpose mouse operations on top of *Brief*. With the pop-up menu, mouse motions and buttons are translated into key input to *Brief*.

To do this, I created a definition file, shown in Figure 1, that defines the mouse left/right and up/down motions as the arrow keys. All seven button combinations possible on the Logitech mouse are mapped to *Brief* key inputs, as follows:

```
left = page up
right = page down
middle = mark
left-middle = copy to scrap
middle-right = delete to scrap
left-right = insert from scrap
left-middle-right = mark column
```

■ **MOUSE SUPPORT FOR BRIEF:** Here is a simple method that allows you to use the Logitech mouse under the *Brief* program editor.

■ **TERMINATING INPUT:** Use this ComInput function to prevent COM port "deadlocks" in QuickBASIC.

■ **AVOID HEAP-BASED PROBLEMS:** Don't let your Pascal programs use every last byte of the heap.

By using these definitions, I can now navigate through and manipulate my text in *Brief*, moving, marking, deleting, copying, and cutting and pasting, without having to

even touch the keyboard except when inserting new text and when performing other *Brief* functions.

Jacques LaFrance
Tulsa, Oklahoma



This is a useful stopgap measure for users of the *Brief* editor; those using Logitech mice should be able to take advantage of this method immediately. Nevertheless, most of us would like to see *Brief* provide its own mouse support—Mr. LaFrance and I cast two more votes for the *Brief* boys to do so.
—Tony Rizzo

TERMINATING INPUT

Many QuickBASIC programmers use the `LINE INPUT #` statement to read lines of text from a communications port. While this method certainly works in many cases, sometimes the PC appears to lock up. This occurs if the required carriage return character is never received. Even BASIC's `ON ERROR` statement cannot be used to trap this situation, because `LINE INPUT` never returns to the program.

To solve this problem, I wrote the QuickBASIC ComInput function shown in Figure 2. ComInput waits for a character to be received and then places it into the caller's string buffer. If no characters are received within a specified time-out period, the function returns and assigns an error code that the caller may test for. An error code is also assigned if the supplied buffer is filled before a carriage return character was received, allowing the caller to process those characters and then invoke the function again. In either case, ComInput returns the number of characters that were received, minus the carriage return and line feed. ComInput can use any characters—not just a carriage return and line feed—to terminate input.

Testing has proven this routine to be extremely fast, since it doesn't rely on string concatenation to build the buffer. Rather, the statement form of `MID$` is used to insert the incoming characters, bypassing the

B.DEF

COMPLETE LISTING

```
-----
;
;      LOGIMENU File definition for Brief Editor
;      by Jacques LaFrance, MPSI Software Inc., Tulsa, OK
;
;-----
begin leftb, middleb, rightb, mousel, mouser, mouseu, moused, 5, 10
;NOTE: with 2-button mouse, "middleb" means both buttons
;
leftb:           type 0, 73 ; PAGE UP
middleb:        type 0, 50 ; ALT M = MARK
rightb:         type 0, 81 ; PAGE DOWN

chords lmb, lrb, mrb, allb

lmb:            type 0, 78 ; KEYPAD + = COPY
lrb:            type 0, 82 ; INS
mrb:            type 0, 74 ; KEYPAD - = DELETE
allb:           type 0, 46 ; ALT C = COLUMN MARK

mousel:         type 0, 75
mouser:         type 0, 77
mouseu:         type 0, 72
moused:         type 0, 80

; end of definition file
```



Figure 1: This definition file maps the seven button combinations possible on the Logitech mouse to key input used by the *Brief* editor.

Languages

COMINPUT FUNCTION

COMPLETE LISTING

```

DEFINT A-Z

DECLARE FUNCTION ComInput% (Handle%, Timeout%, Buffer$, Term$, ErrCode%)

OPEN "COM1:1200,N,8,1,BIN" FOR RANDOM AS #1 'Open the COM port

Handle = 1 'Specify the file handle
Timeout = 5 'Set time-out to 5 seconds
Buffer$ = SPACE$(256) 'Make a 256 character buffer
Term$ = CHR$(13) + CHR$(10) 'Specify the line terminator string

DO 'Read a line of data
  Pointer = ComInput(Handle, Timeout, Buffer$, Term$, ErrCode)
  PRINT LEFT$(Buffer$, Pointer) 'Print the part of buffer filled
  IF ErrCode <> 69 THEN PRINT 'If the buffer didn't overflow
  'print a CR,LF
LOOP UNTIL ErrCode = 24 'Get another line unless we timed out

CLOSE #1 'Close the port

*****
Function ComInput
  Reads characters from a COM port until a terminating string is
  read or the length of the buffer is exceeded or a time-out occurs.
  Replaces BASIC's "LINE INPUT #" routine.
Inputs:
  Handle - The file handle used to refer to the COM port
  Timeout - Number of seconds to wait for each character
  Buffer$ - Padded string which will hold characters read from the port
  Term$ - String used to detect the end of a line
Returns:
  FUNCTION - returns a pointer into the buffer where the line ends
  ErrCode - Flags the success or failure of the function
  0 = No error, 24 = "Device Timeout", 69 = "Buffer overflow"
*****

FUNCTION ComInput (Handle, Timeout, Buffer$, Term$, ErrCode) STATIC

  ErrCode = 0 'No errors yet
  TermLen = LEN(Term$) 'Save length of terminator string
  BufLen = LEN(Buffer$) 'Save length of buffer
  T% = TIMER + Timeout 'Set the value for time-out

  FOR Ptr = 1 TO BufLen 'Assume we will fill the whole buffer
    DO UNTIL LOC(Handle) 'Wait for a character to come in port
      IF TIMER > T% THEN 'Have we waited too long?
        ErrCode = 24 'Set BASIC's "Device timeout" error
        EXIT FOR 'Bail out of loops
      END IF
    LOOP
    'Read the character into the buffer
    MID$(Buffer$, Ptr) = INPUT$(1, Handle)
    'If looking for a terminating string,
    IF TermLen > 0 AND Ptr >= TermLen THEN
      IF MID$(Buffer$, Ptr - TermLen + 1, TermLen) = Term$ THEN EXIT FOR
    END IF
  NEXT

  IF Ptr > BufLen THEN 'Did we go off the end of the buffer?
    Ptr = Ptr - 1 'Fix the pointer
    ErrCode = 69 'Set BASIC's "Com Buffer Overflow" error
  ELSE 'error
    IF Ptr > TermLen THEN
      Ptr = Ptr - TermLen 'Set pointer to before terminator
    END IF
  END IF

  ComInput = Ptr 'Assign the function
END FUNCTION

```

Figure 2: BASIC source-code listing for the ComInput function.

overhead of BASIC's dynamic memory management. I've used this routine successfully to receive input from a communications port at up to 9,600 bits per second

on 8088-based machines without experiencing any difficulties.

Don Malin
Norwalk, Connecticut



QuickBASIC's extensive list of commands and features is one of the reasons it has become such a popular language. Indeed, writing an equivalent to OPEN COM: in C or assembly language would take days, if not weeks. But, as Mr. Malin so aptly points out, there is no automatic way to regain control if the necessary carriage return is never received. His solution is particularly effective, not only because it solves the problem handily, but also because it is extremely fast.—Ethan Winer

AVOID HEAP-BASED PROBLEMS

Turbo Pascal 5.0 allows a program to allocate and free heap memory with two pairs of procedures: New/Dispose, for variables of predefined size; and GetMem/FreeMem, for dynamically sized data. New and GetMem can both allocate memory all the way to the top of the heap. Dispose and FreeMem can deallocate memory from pointers in any order. The manual states, "These procedures [Dispose and FreeMem] allow an application to dispose of any pointer at any time."

Well, make that *almost* any time. The exception is when a program tries to free heap space after an allocation has left 16 or fewer free bytes on top of the heap. When New or GetMem leaves fewer than 17 free bytes, a succeeding call to FreeMem or Dispose respectively gets a fatal error message, "Invalid pointer operation," and a program crash.

The program HEAPBUG.PAS, which is shown in Figure 3, flushes this little beast into view. A possible workaround for this is to use the MemAvail function; this will prevent New and GetMem from allocating the top 17 bytes of the heap.

Richard Biffi
Washington, D. C.



Don't worry, the actual problem has nothing to do with mixing New/Dispose and GetMem/FreeMem. In Turbo Pascal 5.0 or QuickPascal 1.0, New(x) and GetMem(x, SizeOf(x^)) are completely interchangeable, as are Dispose(x) and FreeMem(x, SizeOf(x^)). This assumes that the variable x is not an untyped "generic" pointer—SizeOf(x^)) doesn't work on generic pointers.

The Pascal program's heap manager has to keep track of what memory is available so it can allocate blocks of memory to pointer variables. To keep track of blocks you've freed up, it maintains a Free List—a list of pointers to available blocks.

Languages

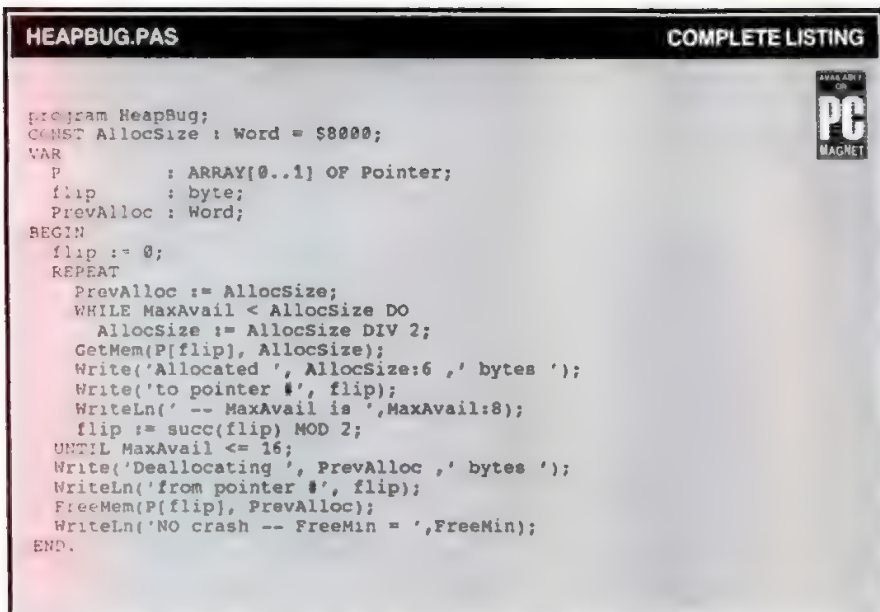


Figure 3: Your Pascal programs can run into trouble if they try to allocate every byte of heap memory, as this program demonstrates.

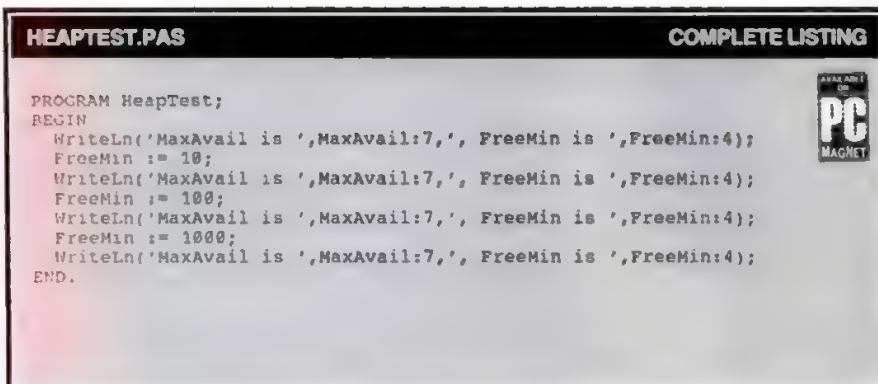


Figure 4: By setting the FreeMin variable to a nonzero value, your Pascal programs can reserve some heap memory for use by the Free List.

The Free List starts at the top of the heap and builds down. If you free up a block that's adjacent to another free block, the two blocks merge.

The HEAPBUG program demonstrates what happens when you attempt to deallocate a pointer and there's no more room on the Free List. HEAPBUG alternately allocates memory to two pointers until the heap has 16 or fewer bytes available. Then it attempts to free up the next-to-last block, but since there's no room for the Free List entry, it crashes.

Both Turbo Pascal and QuickPascal have a built-in variable FreeMin that helps avoid this problem. If you set FreeMin to a nonzero value, the program will reserve that many bytes for the Free List. Those

bytes disappear from available heap memory, as the tiny program in Figure 4 shows. Put the statement `FreeMin := 17;` at the start of the HEAPBUG program and it will run to completion without a hitch.—Neil J. Rubenking

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Tutor

RY

Model 70 with 1MB of
board and a second
an expansion card.
e up, I use IBM-
k-caching utility sup-

S 4.0's MEM command
ve 1,310,720 bytes of total
memory but only 262,144 bytes
Am I using only 20 percent of the
memory in my system? Also, the
t seem to run any faster. Am I us-
tended memory correctly, or
configure it as expanded memo-
now do you judge whether you
anded or expanded memory?

es Palmer

ette, Louisiana

You're using it correctly. As it is,
IBMCACHE.SYS is using a full
megabyte of extended memory to
disk data. The 262,144 bytes avail-
are leftovers that IBMCACHE.SYS
using. Your system has 1,310,720
s, or 1,280K, of extended memory in-
ed, plus an additional 128K used by
system for ROM shadowing that
esn't show up when you type MEM.
dding 1,280K (extended memory),
28K (extended memory dedicated to
hadowing), and the 640K of base memo-
ry yields 2MB, the total amount of usable
RAM installed in your system.

If you want more or less RAM dedicat-
ed to IBMCACHE.SYS, you can adjust
the amount it uses by adjusting the numeric
parameter that follows its name in your
CONFIG.SYS file. For example, the line

DEVICE = IBMCACHE.SYS 512 /E

tells IBMCACHE.SYS to allocate 512K
of buffer space in extended memory. In
your case, dedicating 512K to the cache
would leave 768K for other programs.

If you haven't noticed that your Model
70 runs faster with IBMCACHE.SYS in-
stalled, it could be because you're looking

■ **MISSING MEMORY:** It's
not always obvious how
your extended memory is
being used.

■ **DISABLING THE PAUSE
KEY:** Here's what
happens when you hit
the Pause key, and how
you can prevent its
sometimes disastrous
effects.

■ **UNDERSTANDING
VIDEO DRIVERS:** What
do video drivers do
and why can some
applications get along
without them?

in the wrong place. The cache doesn't
speed up the machine itself; it speeds up
the hard disk. The machine will appear to
run faster only when disk accesses are in-
volved.

To see an example of this, remove the
line that loads IBMCACHE.SYS from
your CONFIG.SYS file, reboot the ma-
chine, and load a large application pro-
gram such as a spreadsheet or word pro-
cessor. Then reinstall IBMCACHE.SYS,
reboot, and load the program again. It
should load much faster this time because
IBMCACHE.SYS eliminates a significant
number of the disk accesses required to
read the program file from disk. The se-
cret: Each time the loader requests a sec-
tor's worth of data, IBMCACHE.SYS
reads that sector plus several more. When
DOS asks for the next sector, IBM-
CACHE.SYS delivers it straight from
memory. Load the program again and it
will load even faster. If your cache is large
enough, IBMCACHE.SYS will pull all
the data from memory without having to
access the hard disk even once.

How much memory should you dedi-

cate to disk caching? IBMCACHE.SYS
uses a form of caching known as *set asso-
ciative caching with look-ahead*. The
beauty of this kind of cache is that you
don't pay performance penalties for large
buffer sizes. The configuration you have
now, with 1MB of your 1,280K dedicated
to cache buffering, strikes a reasonable
balance between cache memory and mem-
ory reserved for other purposes—espe-
cially since precious few DOS applications
will even use extended memory.

Whether you need extended memory or
expanded memory depends upon what ap-
plications you run and what kind of memo-
ry (if any) beyond the 640K of convention-
al memory they will use. There are more
programs that use expanded memory than
extended memory—*Lotus 1-2-3* and
Microsoft Windows/286, for example.
Others, like IBMCACHE.SYS, won't use
expanded memory but will use extended.
A few applications, such as *AutoCAD*,
will use either. Configure memory in the
way that's compatible with the majority of
your programs.

If you find yourself needing both, pick
up a copy of Qualitas's *386-to-the-Max* or
Quarterdeck Office Systems' *QEMM-*
386. These utilities allow 386 memory to
be split between extended and expanded
memory or even toggled back and forth
with simple commands. See the Tutor col-
umn in the January 16, 1990, issue of *PC*
Magazine for a more in-depth discussion
of their capabilities.

DISABLING THE PAUSE KEY

Can you please explain what happens
when I press the Pause key on a Model 80?
Are all programs suspended, only those
running in the foreground, or only those
awaiting keyboard input? Is there any way
to disable the Pause key? I was surprised
to find that I could crash our LAN database
server by pressing Pause. There should be
a way to protect the system from such a
simple action.

Darcy Hille

Atlanta, Georgia

Tutor



When you press the Pause key or the combination of Ctrl and NumLock under DOS, the keyboard BIOS sets a flag (bit 3 of the byte at offset 18H in the BIOS data area) and enters a do-nothing loop until the flag is cleared. The flag—also known as the pause bit—is cleared when the next key is pressed. In DOS, an inherently single-threaded operating system, all processes are suspended until a key is pressed.

Interrupt-driven processes are excluded because they operate asynchronously with respect to the main processor thread. When a key is pressed, for example, a hardware interrupt is generated that temporarily transfers control to an interrupt handler in the keyboard BIOS. The key-press is processed (that's why the pause bit can be cleared even though the processor is stuck in a delay loop) and control is returned to the process that was momentarily interrupted. As a result, you can pop up a TSR that responds to the keyboard even though Pause has been pressed. An interesting aside is that even an interrupt-driven thread will be frozen if the Pause key is pressed at the exact instant that the thread has control of the CPU.

It's easy to whip up a short utility to disable the Pause key under DOS. A DEBUG script for doing so is shown in Figure 1.

The program, a short TSR called NOPAUSE.COM, hooks into the timer interrupt (interrupt 08H) and checks the pause bit in the BIOS data area at each timer tick. If the pause bit is set, NOPAUSE clears it and the keyboard BIOS immediately exits the pause loop. In truth, NOPAUSE doesn't really disable the Pause key—it just kicks the PC out of pause mode as soon as it sees that the key has been pressed.

UNDERSTANDING VIDEO DRIVERS

I'm perplexed about video drivers: what they are, what they do, and when they're required. For example, why do some applications come with disks full of video drivers for different display adapters, while others come with none at all? If an application program provides several different VGA drivers, but none for the particular brand of VGA that I have, does it mean I can't run that program?

Donald I. Christensen
East Longmeadow, Massachusetts



A video driver serves as an interface between an application program and the display hardware it's running on. If a program wants to draw a line across the screen in graphics mode without using the slow routines built into the video BIOS, for example, it has to know something about the structure of video memory on the particular adapter it's

running on.

er's registers.

more portable is a
tion Programming Program the adapt-
set of video drivers
API. To draw a line, the
call to the driver. The driver
the pixels necessary to draw

Video drivers come in many forms. Most programs that run in video mode have only embedded video routines which usually amount to no more than a few subroutines. The reason: Calls to the video BIOS vary little from one adapter to another. Once the program determines where the video segment is, checking for monochrome or color is the same set of routines can serve virtually all video adapters, from CGAs and MDAs all the way up to VGA and 8514/A adapters.

Programs such as AutoCAD and WordPerfect, Version 5.0, which do all or part of their work in graphics mode, often supply drivers in the form of standalone files that are loaded by the program. The advantage to breaking drivers out separately is that the program has to carry along only a set of routines specific to the adapter it's running on, resulting in a substantial savings in memory.

If you're running a program that comes with video drivers, you should first try to find one that matches the display adapter in your system. If you can't find one, try using drivers for other boards of the same type. If you have a no-name VGA clone and it's truly compatible with an IBM VGA, then it should run using the IBM VGA driver. The only drawback is that someone else's driver may not take advantage of special features of your board that could make the program work faster or better. One example: if your board has Super VGA capabilities (800 by 600 graphics) but you run it with an IBM VGA driver, you can bet that it runs at 640 by 480 even though it's capable of much more.

A question that's often asked is how feasible it is to write your own video drivers. The answer is that it's quite difficult. First, you have to know your adapter inside out. Usually that means delving into the intricacies of some arcane instruction set or programming interface to find out how to make the adapter do what you want it to.

Second, you have to know something about the application program: what format it expects the driver to be in, how it calls the driver, and what it expects the driver to do. Every program expects some-

NOPAUSE.SCR

COMPLETE LISTING

```
N NOPAUSE.COM
A 100
JMP 0121
DB 0,0,0,0
DB 40,0
PUSH DS
CS:
MOV DS,[0107]           ;Point DS to BIOS data area
TEST BYTE PTR [0018],08 ;Pause bit set?
JZ 011B                 ;No, then exit
AND BYTE PTR [0018],F7  ;Yes, then reset it
POP DS                  ;Restore DS and exit
CS:
JMP FAR [0103]
MOV AX,3508              ;Get current int 08H vector
INT 21
MOV [0103],BX           ;Save it
MOV [0105],ES
MOV AX,2508              ;Hook into interrupt 08H
MOV DX,0109
INT 21
MOV DX,0121              ;Terminate but remain resident
INT 27

R CX
JB
W
Q
```

Figure 1: This DEBUG script will create NOPAUSE.COM, a TSR that disables the Pause key and the Ctrl-NumLock key combination under DOS.

3,000,000.00

SAYS WE KNOW WHAT WE'RE TALKING ABOUT...



glad-
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☐ **INDIVIDUAL CREDIT** but rely on income or assets of another person as a basis for repaying the credit requested. Complete entire application.
☐ **INDIVIDUAL CREDIT**. Complete sections "a" and "b" only.

Please complete all appropriate sections, providing at least two year's residence and employment history. This will enable your application to be processed as quickly as possible. If you are self-employed, please be sure to complete section "d" on back.

Applicants must be 18 years of age or older.

a. Your Personal Information										Requested Line of Credit \$			
Your Name:		First	Initial	Last	Date of Birth:			Mo		Day	Yr	Social Security Number:	
Present Address:		Street		Apt. #		City		State		Zip		Home Phone () -	
Date of Residence:		Month		Year		Monthly Payment: \$		Buy		Rent		Other	
Previous Address:		Street		Apt. #		City		State		Zip		Home Phone () -	
Your Employer: (If self-employed, see rear panel)		Date of Employment:		Mo		Yr		Position:		Monthly Income:		Gross \$ Net \$	
Employer's Address:		Street		City		State		Business Phone:		() -			
Previous Employer:		Address:		City		State		Dates of Employment:		From		To	
Income from alimony, child support or separate maintenance payments need not be disclosed if you do not wish to have it considered as a basis for repaying this obligation.		Other income:		I have received since: (Date)		Monthly Income:		Gross \$		Net \$			
Name and Address of Nearest Relative Not Living With You:										Relationship:			

b. Credit Information										Include joint applicant's information, if joint account requested	
Bank Account:		Bank Name		Address		☐ Checking ☐ Savings		Payment		Balance	
Bank Account:		Bank Name		Address		☐ Checking ☐ Savings		Payment		Balance	
Bank Loan Reference:		Bank Card Reference:		Other Credit Card Reference:		Other Credit References:		Account No:		Expires:	
Driver's License No.		State:		Expires:							

c. Joint Applicant's Personal Information										*If you are a married Wisconsin applicant, you must provide your spouse's information below, even though your spouse may not be signing this contract.			
Joint Applicant's Name:		First	Initial	Last	Date of Birth:			Mo		Day	Yr	Social Security Number:	
Address:		Street		Apt. #		City		State		Zip		Home Phone () -	
Employer:		Date of Employment:		Mo		Yr		Position:		Monthly Income:		Gross \$ Net \$	
Employer's Address:		Street		City		State		Business Phone:		() -			

d. Self-Employed Information										Complete this section only if you are self-employed	
Business Name:		Business Address:		Description of Business:		Your Position:		Business' annual income:		(gross) (net)	
1. Business Bank:		Name		Telephone () -		Personal Banker's Name:		Telephone () -			
2. Accountant's Name:		Name		Telephone () -							
3. Financial statement on business attached.										PCM410	

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by
Frank J. Derfler, Jr.

Connectivity

THE ISDN CONNECTION

Our review of Integrated Services Digital Network (ISDN) products for the PC in the February 13, 1990, issue of *PC Magazine* prompted many questions and comments from readers. In that article, we complained that ISDN adapters for the PC are expensive and, with a few exceptions, lack a common interface for application programs.

Several readers wrote to ask what can be done with a PC-based ISDN installation *today*. There were also some vocal folks who have a problem with ISDN's incoming call identification (ICLID). They claim that providing the ability to identify the caller is an invasion of the caller's privacy! This convolution of logic not only boggles the mind, but it also clouds one of the real values of ISDN: PC connectivity. Let's dispose of the ICLID disagreement first, and then we can talk about other uses for ISDN on the PC.

The identification of the calling telephone comes from the ISDN switch in the form of a telephone number. If this number is routed to a database, it's possible to present the person answering the call with a screenful of information about the caller. You can buy database services from the company providing ISDN, but PC-savvy managers would probably elect to save money and get customized service by creating their own DBMS containing proprietary information about their calling clients.

Some companies package a database-management system with the ISDN adapter board, but if you develop a large database of callers, you'll probably want a more powerful multiuser networked DBMS. Many organizations will want their own DBMS software to provide look-up services, but routing the incoming ICLID from the adapter board to the DBMS can be a challenge.

All of the companies marketing ISDN adapters designed some kind of an interface for people developing applications. Progressive Computing's ((312) 574-

■ **THE ISDN CONNECTION:**
This new digital phone system has the potential to transfer data at longer distances than LANs.

■ **DISK CACHING ON A NETWORK:**
Disk caching improves server performance.

3399) interface packaged in their ISDN tel/adaptor is an excellent example. This package includes software you can program to look for specific incoming data and then to move that data to the PC's keyboard buffer along with a predefined string of characters.

This technique for stuffing the keyboard buffer gives you a way to interface the ISDN adapter to practically any DBMS software. There's a penalty, though. You give up 70K of RAM to the keyboard-routing software.

If you don't want to give up that RAM, you can create your own programs to move the ICLID to a DBMS using the C programming language library that Progressive Computing provides. Even a novice C programmer can create an application that declares itself to the driver software for the ISDN tel/adaptor and then executes a C function call telling the driver when to wake the application.

When it's called, the application pulls out the phone number and other information delivered by the ISDN adapter. Then other C library functions can write the information to a file or deliver it to a DBMS.

Using the ICLID to feed a database is indeed useful, but focusing on this function alone obscures the important fact that PCs using ISDN are able to transfer data over longer distances than a LAN allows.

A local area network moves data at a rate of millions of bits per second to hundreds of stations attached to a cable with an

overall length of a few thousand feet. Modems for dial-up telephone lines move data at thousands of bits per second between two points practically anywhere on earth. ISDN potentially lets you move data at a rate of hundreds of thousands of bits per second to hundreds of simultaneous locations around the world.

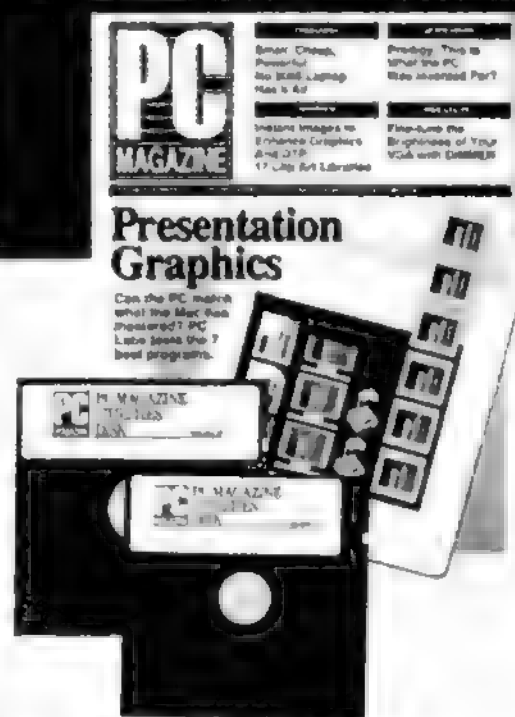
But even at a combined data rate of 128 kilobits per second, ISDN is too slow in many situations. DOS simply does not work efficiently over the two 64-kilobit-per-second channels ISDN provides. If you want a file server many miles away to appear as a drive letter on a local PC so that an application program can access a large database, look for a faster connection scheme. And frequently transferring megabytes of data for graphics or large DBMS applications is too big a load for ISDN. A 1.544-megabit-per-second leased point-to-point data channel is more appropriate for these kinds of jobs.

However, ISDN is great for many of the most popular LAN tasks. If you want to move batches of electronic mail or other moderate-size files between distant LANs, update electronic mail servers, send print jobs to distant print servers, or remotely control a PC on a distant LAN, ISDN is just right. ISDN also works well for work-group productivity utilities such as group and resource scheduling and cooperative document authoring, and on-line ISDN is perfect for remote terminal-emulation connections. You can attach a PC to an ISDN switch and simultaneously initiate multiple 3270 SNA connections to mainframes scattered around the city, the country, or the world.

Because ISDN provides the capability to conduct multiple simultaneous communications sessions, it is a perfect match for the multitasking capabilities of OS/2. NCR and ICL Network Systems market ISDN adapters with software for OS/2.

But there are some flaky patches of paint on this pretty picture of ISDN. Some stubborn problems remain in the ISDN architecture, and there are other problems

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Connectivity

unique to the way ISDN works in PCs.

While you can order ISDN services in many cities today, it is doubtful that the service you buy will allow you to communicate outside of your local neighborhood on ISDN. Software implementing a protocol for an ISDN connection between long-distance telephone switches across the country, called Signaling System number 7 (or SS7), won't be widely implemented until the middle of this decade. Today, the

**NetBIOS provides a
dandy way to move
data at a high speed
through an I/O port.**

United States is an archipelago of ISDN "islands." The links between these islands will grow slowly. MCI leads the major long-distance telephone carriers in implementing SS7, so if you need long-distance ISDN, give MCI a call.

Within the PC, application programs can address the ISDN adapter as a serial port, but this method of interfacing programs to the adapter doesn't take advantage of the full speed of the ISDN channels. The not-quite-standard interface familiar to LAN managers, NetBIOS, provides a dandy way for applications to move data through an I/O port at a high speed. Terminal emulators, e-mail packages, remote-control programs, and other LAN applications can use NetBIOS.

Unfortunately, only a few of the manufacturers of ISDN adapters provide a NetBIOS interface. Fortunately, Hayes Microcomputer Products designed and recently published the specifications for an ISDN interface built on NetBIOS, called ISDNBIOS. Hayes also extended its AT command set to include ISDN functions.

You can buy the documentation and a subscription for follow-on changes by calling Hayes at (404) 441-1617. Hayes charges \$125 for each documentation set.

If you are really interested in developing products for and using ISDN, you should be aware of *ISDN News*, published

by Phillips Publishing, 7811 Montrose Rd., Potomac, MD 20854; (301) 340-2100. This newsletter costs \$397 per year and provides the latest information on the ISDN industry.

DISK CACHING ON A NETWORK

We use the *LANtastic* network in our office. I am interested in the disk-caching utility, DCACHE, that you provided in the October 11, 1988, issue of *PC Magazine*, but I'm afraid to try it on our server. I don't know if it can work on a multiuser system. What do you think about disk caching for *LANtastic* in general and DCACHE specifically?

William Ozmund
Chicago, Illinois



It's our experience that DCACHE isn't robust enough for a LAN server. Specifically, the algorithm in DCACHE doesn't hold on to recently used data well enough to satisfy the needs of a server operating under requests from multiple applications.

V-Cache, from Golden Bow Systems, works well as a caching program for *LANtastic* and all other DOS-based LAN operating systems. The \$59.95 package includes three different cache programs—one for extended, one for expanded, and one for conventional memory.

By the way, there is a cache program built into IBM's *PC LAN*, and Artisoft includes a new cache program with Version 3.0 of *LANtastic*.

The performance improvement you get from a disk-caching program depends a great deal on what you ask the server to do. Repetitive requests fly to the workstation from the server, but the first request for a block of data isn't any faster than it would be in a system without a cache.

We don't recommend using the write-through cache available in DCACHE and other programs. Delaying writes is too dangerous for DOS-based servers.

NETWORK YOUR QUESTIONS

Connectivity gives you practical solutions to networking problems of all types. We'll pay \$50 for any tips we print. Please submit your letter on a disk along with a print-out. Then mail your contributions to Connectivity, *PC Magazine*, One Park Avenue, New York, NY 10016, or you may contact Frank J. Derfler, Jr., via MCI Mail (be sure to use Derfler's box named PC MAGAZINE LAN LABS). We're sorry, but we're unable to answer letters personally.



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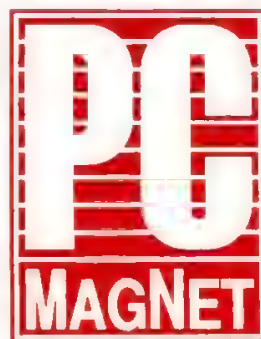
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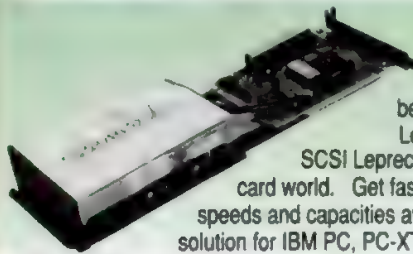
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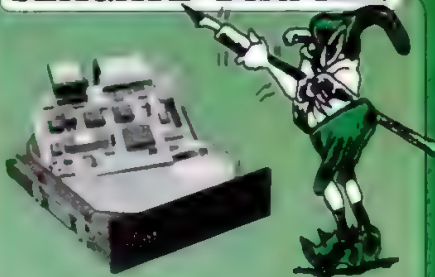
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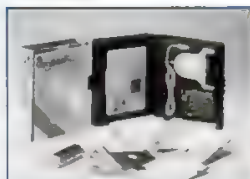
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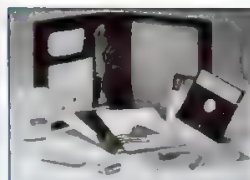
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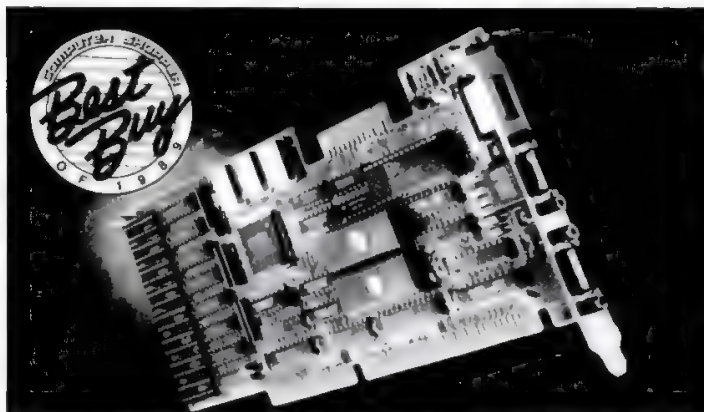
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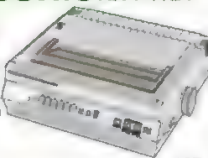
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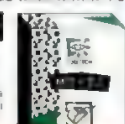
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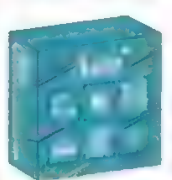
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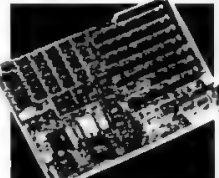
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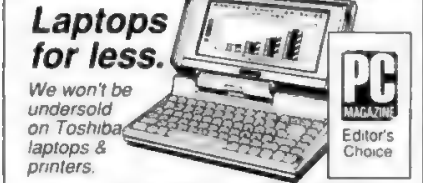
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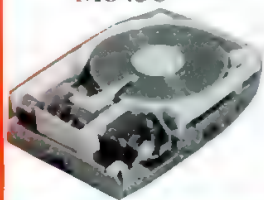
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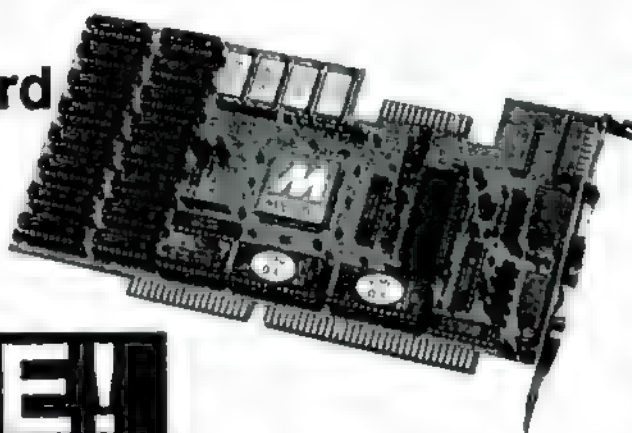
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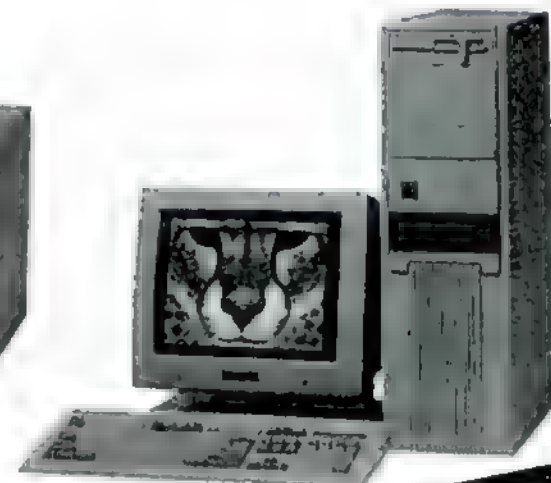
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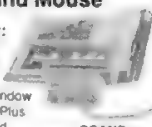
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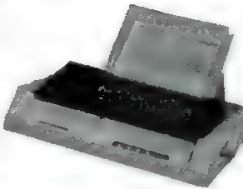
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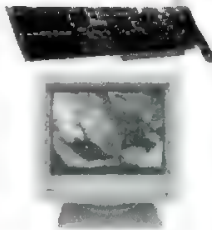
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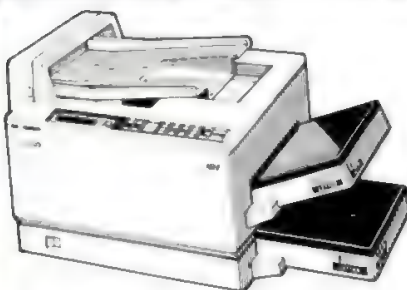
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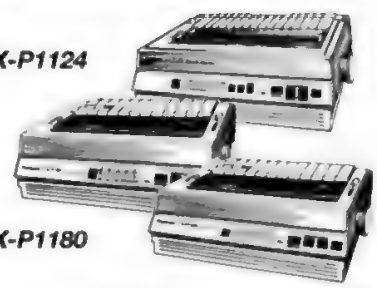
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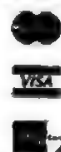
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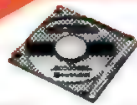
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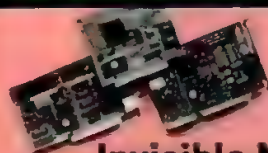
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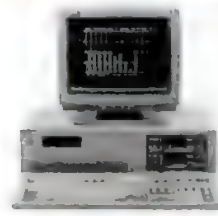
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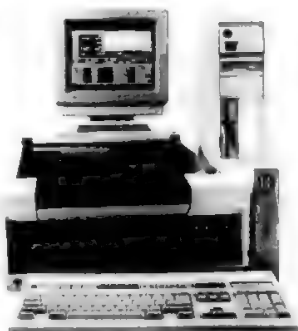
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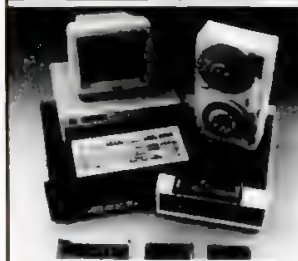
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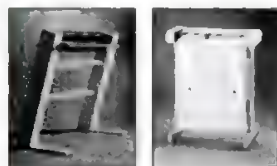
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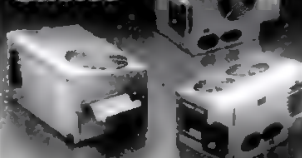
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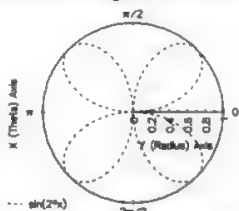
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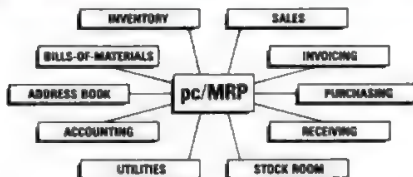
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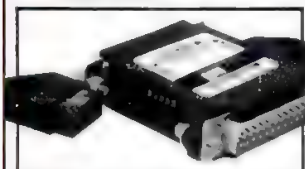
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- o. ☐ Linked to mainframe
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q. ☐ Networked together

6. Does your company own

- r. ☐ Mainframe(s) i. ☐ VAXes

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7. Do you plan to buy any PC product?

- u. ☐ Now
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8. Number of employees in your entire company?

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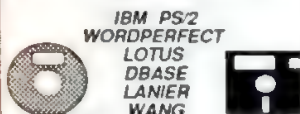
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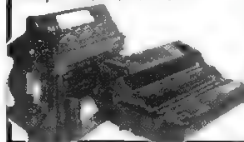
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■ HIGH-END SPREADSHEETS

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In addition to our comparative reviews, we'll delve into the world of financial publishing and find out how some of these products are optimized for the task. We'll also take a look at the preliminary releases of *Lotus 1-2-3/G* and *WingZ* to show you what's in store for spreadsheets.

■ ZERO-SLOT LANs

Zero-slot LANs are best for small setups of two to three workstations where simplicity and low cost count. Available packages in this category have grown to incorporate virtual-drive capabilities, parallel connections, even true print spooling and electronic mail. PC LAN Labs tests five products, including *DeskLink* and *LANtastic/Z*, plus the virtual-drive components of three popular file-transfer packages.

■ HIGH-RESOLUTION PRINTER BOARDS

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■ DATA PROJECTION SYSTEMS

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After Hours

Products for the Leisure Side of Personal Computing

PC Globe Fits the Whole World onto Your Hard Disk

EDUCATION
by Barry Simon

Paper atlases aren't very user-friendly. If you can't quite remember a country's name, for instance, you might have to locate it on a world map, look it up in an index, and then thumb to the desired country map. Wouldn't it be much easier just to point at a country on a world map and zoom directly to the individual country map?

That's what a computer atlas should do, and that's exactly what you can do with Version

regions, continents, and individual countries. *PC USA* covers the entire United States including Alaska, Hawaii, and Puerto Rico. There are also regional maps and individual state maps.

PC Globe offers flexibility that would be difficult if not impossible to duplicate on paper. For each country or state, you can display rivers or major cities, or you can elect to view color-coded elevations. There are lists of almost a thousand U.S. cities and more than a thousand international cities

worth. Some of the data—like age distributions, for example—appears in graphic format. Other information is text-based. For each state, *PC USA* gives you a choice of 19 topics, including a screen of historical facts and climate information for major cities. By the time this article appears, the publisher expects to have released an add-in for *PC Globe* called *PC Nations*, which will display the flag and play the national anthem for each country.

Besides data on individual countries or states, you can get comparative listings among countries with *PC Globe* and among states with *PC USA*. *PC Globe* has data on 84 items in the categories of demographics (such as population growth),

EDUCATION

Car Builder
Kiddy-Car CAD

GAMES

Hero's Quest
combines fantasy
and adventure

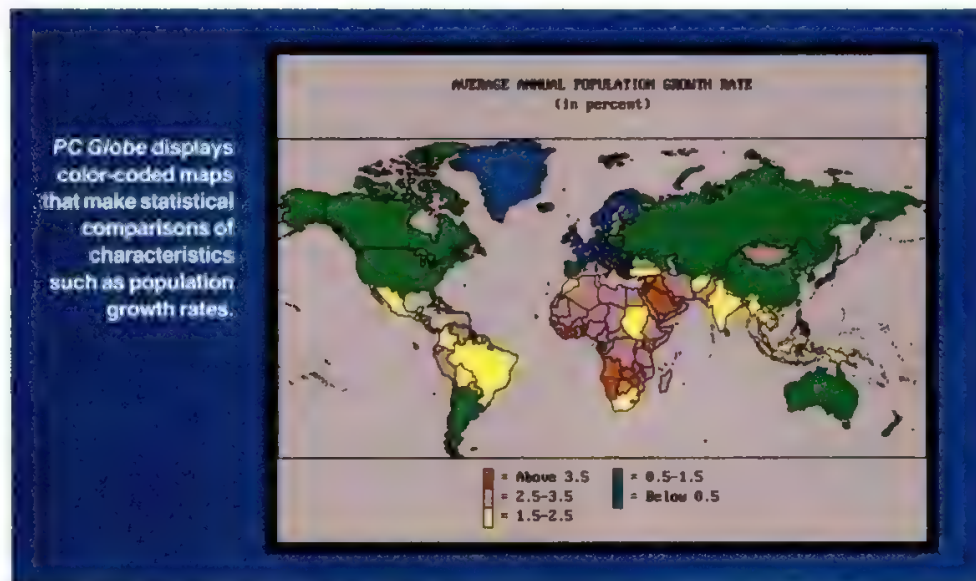
Silpheed: A
standout among
shoot-'em-ups

PC USA has data on over 150 items, including commodity production and crime statistics. You have the same display options as with *PC Globe*. These programs do a great job of data compression, but they still eat considerable disk space: *PC Globe* takes about 1.5MB and *PC USA* about 1MB.

Although you can get hard-copy printouts from either *PC USA* or *PC Globe*, printer support is rather limited. The Hewlett-Packard LaserJet is supported, but only at 150 dots per inch. Among dot matrix printers, the IBM Graphics printer (and compatibles) will work, but the software has no drivers for the Toshiba family. You can generate color output with several different printers, but the software lacks drivers for the HP PaintJet. PostScript support is also missing.

Maps can be saved in .PCX format, but here the programs trip over the fact that the so-called .PCX standard has changed so often that it isn't quite a standard. The .PCX files were fouled up when I tried to load them into *PC Paintbrush*, *Deluxe Paint*, or *Hotshot Graphics*. *PageMaker* refused to load the .PCX files I made with *PC Globe*. But the files weren't totally corrupted. Not only could *PC Globe* display

CONTINUES



3.0 of *PC Globe* and its companion program, *PC USA*. They amount to an on-disk atlas with point-and-shoot capability. If you would rather not point and shoot, you can choose from a list or fill in a name field that is intelligent enough to know that Ceylon is really Sri Lanka.

PC Globe offers maps of the whole world as well as maps of

you can locate. The U.S. map lets you isolate area codes and ZIP codes, although for the former (and some of the latter) you'll see only the relevant state and not where in the state the code is used.

The software can also display detailed statistical information. For each country, *PC Globe* gives you ten screens'

economic data (gross national product per capita), health statistics (birth rate), and commodity production. For each, you can eyeball a color-coded world map, or peruse a list of the top or bottom ten countries in each category. A particularly powerful feature lets you compare up to 11 countries, chosen either from a list or by pointing at a map.

After Hours

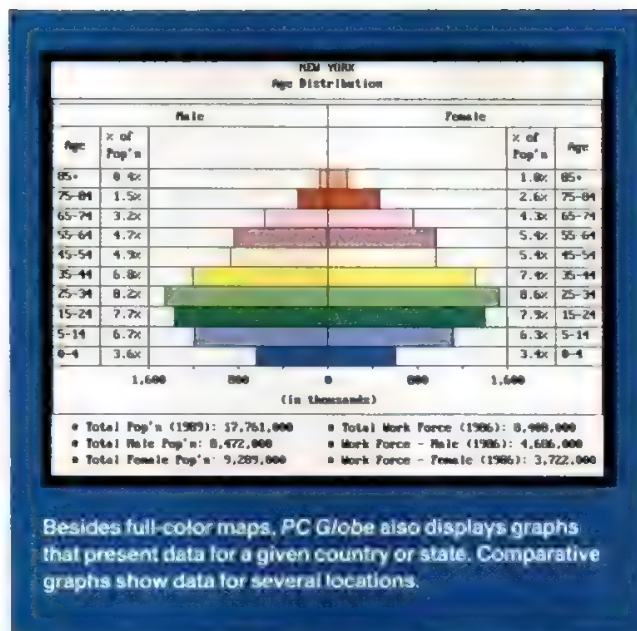
PC Globe

CONTINUED

them again, but two file-conversion utilities I have, *DoDot* and *The Graphics Link Plus*, could read them as well.

Besides the limited printer support and .PCX problems, there are a few other lacks and limitations. Some of the data is not so current—it dates from 1985 or 1986—although most is more recent. It would be helpful if you could save .PCX files with colors changed to dithered patterns, for those with color monitors but black-and-white printers.

But these issues are minor. *PC Globe* and *PC USA* are superb programs that make geography come alive. They are a foretaste of what we'll get in this realm when multimedia and CD-ROM technology finally



come into wider use.

List Price: *PC Globe*, Version 3.0, \$69.95; upgrade from *PC Globe Plus*, \$20. *PC USA*, \$69.95. **Requires:** 512K RAM,

graphics adapter, DOS 2.0.

PCGlobe Inc., 4700 S. McClintock, Tempe, AR 85282; (800) 255-2789.

CIRCLE 403 ON READER SERVICE CARD

Car Builder: Simple CAD for Young Designers

EDUCATION
by Robin Rankin

Here's a great hi-tech idea with a disappointingly low-tech implementation. *Car Builder* is a sort of "CAD for Kids." The budding engineers (ages 8 and up) design and test their own automobiles, paying careful attention to a slew of aerodynamic, power, and performance features. After the car is designed, it's tested and modified accordingly. What a way to learn!

Unfortunately, the game, ported from its original Apple version, uses uninspiring CGA graphics and offers a canned, limited selection of predefined design choices. The road-test simulation offers an unsatisfy-

CONTINUES



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After Hours

Car Builder

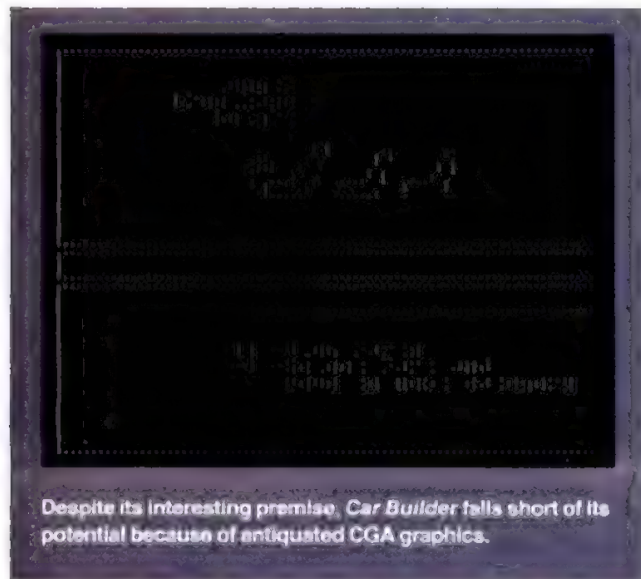
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ing text-based summary of your car's performance, with no guidelines on how to make improvements.

The Car Builder screen is divided into four quadrants. One part displays a crude approximation of the car part you select, along with your overall car design. Another contains sub-menu options. Another reminds

power, torque, displacement, mount, and weight.

Instead of selecting each of these characteristics individually, you look at a full description of the whole engine and then choose. Kids tend to learn best when complex elements are broken into small, manageable parts. When they need to think about five engine attributes at once, they guess! The program encourages haphazard guessing. Once in a while there's nice feedback—for instance, when you shove a midmount engine into a three-seat car.



Despite its interesting premise, *Car Builder* falls short of its potential because of antiquated CGA graphics.

you of the appropriate command keys, which are predominantly arrow keys. Finally, you view a stick-figure schematic of the area you are working on.

You work through the menus, first with the mechanical structure and then with the body design of the car. Even those who don't know a radiator from a gas tank will find themselves learning. To get you started, the software comes with a technical glossary reprinted from *Car and Driver* magazine.

The mechanical portion of the program is broken into major categories that include chassis/drivetrain, suspension/steering, and tires/brakes. Each of these has four or five subcategories. So, for example, you toggle through the menus and choose the Engine category within the Chassis/Drivetrain menu. Each engine type has an array of specs, including horse-

power, torque, displacement, mount, and weight. Instead of selecting each of these characteristics individually, you look at a full description of the whole engine and then choose. Kids tend to learn best when complex elements are broken into small, manageable parts. When they need to think about five engine attributes at once, they guess! The program encourages haphazard guessing. Once in a while there's nice feedback—for instance, when you shove a midmount engine into a three-seat car.

If the mechanical design is limited, the body design is straightjacketed. You work with the front, roof, and rear sections of the car, but the choices are limited to a few modifications for each. Those foolish enough to try to modify their own designs will have to cope with a fat-bit type/graphics editor that makes the original *MacPaint* look hi-tech. The biggest disappointment comes in the car test. You perform wind and road tests, but, as the kids ask, "Where's the action?" The wind test shows the flow of a stream of blue lines around your car. It provides good feedback only for a perfectly symmetrical sports car. The road test shows a nine-point road course on half the screen while the other half lists the pros and cons of your car design. You'll get vague feedback such as "Taking high speed corners

in this car is scary," but you won't have the foggiest idea what to do about it.

Optimum Resource is famous for its *Sticky Bear* series, a set of animations that teaches prereading skills. Too bad none of the *Sticky Bear* whimsy surfaces in *Car Builder*. The premise has potential, but aspiring engineers may change career paths after this simulation.

List Price: *Car Builder*, \$49.95.

Requires: 256K RAM; CGA, EGA, or VGA graphics adapter; DOS 2.0 or higher. Optimum Resource Inc., 10 Station Pl., Norfolk, CT 06058; (800) 327-1473, (203) 542-5553.

CIRCLE 404 ON READER SERVICE CARD

Hero's Quest Sends Gamers In Search of Adventure

GAMES
by Don Trivette

After climbing a snow-covered path, I reached a Victorian mansion set at the very top of Magic Mountain. I was about to set foot on the front porch when an ugly gargoyle spoke up and asked me three questions. Who was I? Whom did I want to see? And who protected the nearby village?

The first was easy: I was a fighter hoping to perform enough good deeds to become a

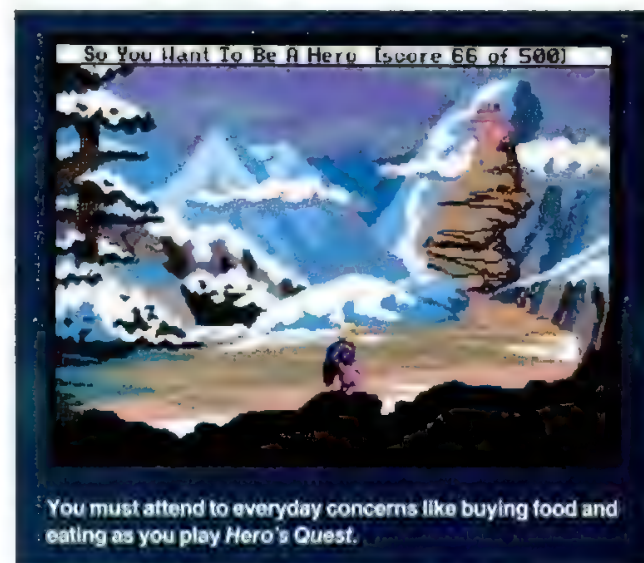
genuine, certified hero. The second question was a little tougher, but I guessed correctly that it was a wizard I was seeking to visit. The third question was a real bummer. When I speculated that the aforementioned wizard also protected the town, the talking porch decoration promptly zapped me to the bottom of the mountain.

That's just one of the perils you'll encounter in Sierra's newest adventure game, *Hero's Quest*. This latest quest has a new twist: it combines the character development and combat typical of FRP (fantasy role playing) games with the adventure-game format made popular by other Sierra games like *King's Quest* and *Space Quest*.

In *Hero's Quest* you take a fighter, a user of magic, or a thief as your character. Each has special attributes and powers, and each approaches the business of becoming a hero in a different way. In a jam with a monster, for example, the magic user would likely cast a "calm" spell or perhaps throw a "dazzle" over the creature to blind it; the thief would simply try to slip quietly away unnoticed; and the fighter, of course, would stand and do battle.

As you use some of the talents unique to your character, you amass points that increase your power. Not only that, if you save your character profile at the end of the game, you can pick up with the same character

CONTINUES



After Hours

Hero's Quest

CONTINUED

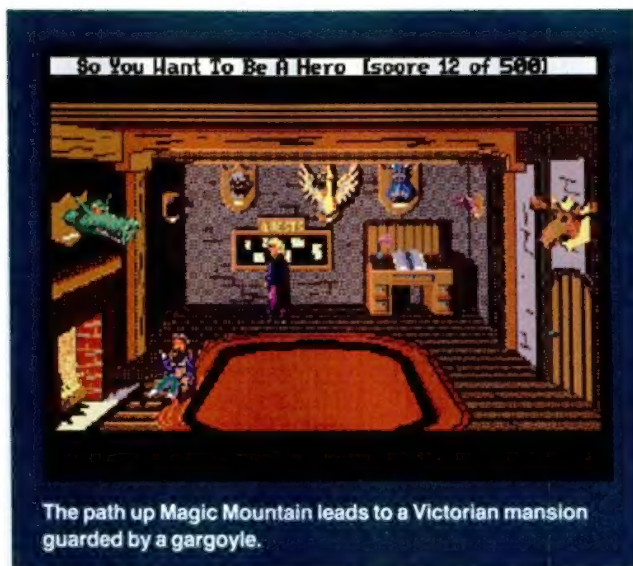
in the forthcoming sequel, according to persistent rumors.

Hero's Quest is one of the few games that incorporates touches of everyday life. Your time is divided into days and nights, and when it's night you had better find a protected place to sleep. Sleep restores health, stamina, and magic points. You must also buy food and other supplies from stores in towns, and if you can't afford food, you will have to get a job or earn a reward.

Indeed, while looking for work on the bulletin board in the Fighters' Guild Hall, I got my first clue as to what my quest was about. Along with a notice offering a reward for the return of a ring and another bulletin offering 50 gold coins for the safe return of Elsa von Speilburg, I found an offer of 60 gold coins and the title "Hero of the Realm" for the capture of the Brigand Leader. Forget Elsa, I'm looking for the Brigand.

After leaving the Guild Hall I moseyed over to the saloon and ordered a drink of Dragon's Breath. Here's a tip: order something else. Further exploration of the town of Speilburg (some coincidence, huh?) revealed a sheriff's office, a magic shop (where I would have stopped had I been a magic user), a barber shop, and several other closed emporiums. I've been playing Sierra games long enough to know that if I pick up the right item or complete a certain task, these closed doors will open, so I ventured into the countryside.

By the middle of the second day, I hadn't seen hide nor hair of a Brigand. Nor had Elsa turned up. I'd picked up a strange assortment of food, armaments, and various flora. In addition, I had 6 gold coins and 44 silver coins. Critics of Sierra games have always asked, "How can he carry all that stuff?" I'm pleased to report that a note on my inventory indicated I was carrying 49 pounds out of a maximum 64 pounds.



The path up Magic Mountain leads to a Victorian mansion guarded by a gargoyle.

I can't tell you how *Hero's Quest* ends—although the developer promised me a spectacular finish—because I'm still at the foot of Magic Mountain. But I did discover the answer to the third question. Before I become a hero, I expect to meet with goblins, goons, giants, minotaurs, trolls, ogres, mantrays, griffins, and dragons.

If you like Sierra's adventure games, you'll like this one. Since it lets you play as any of three characters, it's almost like having three separate games. For me, *Hero's Quest* doesn't quite live up to the *King's Quest* standard, but until *KQ V* appears, it'll do.

List Price: *Hero's Quest*, \$59.95. **Requires:** 512K RAM, DOS 2.0 or later, graphics adapter. Hard disk, 8-MHz or faster processor recommended. Supports a variety of music synthesizers. Sierra On-Line Inc., P.O. Box 485, Coarsegold, CA 93614; (209) 683-8989.

CIRCLE 406 ON READER SERVICE CARD

Silpheed Offers A Variation on Arcade Sights and Sounds

GAMES
by Don Trivette

The object of *Silpheed* is to destroy the giant spaceship Gloire and defeat the Xacalite. Yep, it's another space shoot-'em-up

set in the distant future, but one with some redeeming variations. Unlike so many other flash-in-the-pan arcade games, this one seems to have some staying power. Since I first booted it some months ago, *Silpheed* has remained a favorite with the local arcade commandos. They show no signs of flagging interest. That's unusual, given the short attention span of the typical joystick junkie.

Imported from Japan by Sierra On-Line, *Silpheed* is a

(a high-performance fighter), and Gonosu (a guided-satellite defense weapon).

As you fly *Silpheed* through each area, you accumulate points by destroying the enemy. By capturing various space debris (letters), you increase your chance of success. S, for example, speeds up your craft.

At the end of each level you automatically land on a repair-and-supply ship; for every 50,000 points, you can select new, more-powerful weapons. And, of course, there are shields and engines to be fixed. Players lucky enough to have an Ad Lib, Roland, or IBM music card attached to the computer will hear a different stereo soundtrack for each area.

The key to winning is to get as many weapons as possible in the first part of the game. This means you must rack up mega points at the beginning. Try to get at least 150,000 points before you get to Area 3 so you can buy a V-Beam. You'll need it later.

Silpheed—which is Japanese slang for jet fighter—has good 3-D graphics, lots of action, superb optional sound, passable PC sound, and enough arcade action to challenge even



Silpheed offers familiar arcade action with great sound.

follow-up to the best-selling *Thexder*, also of Japanese origin. This time you fight your way through 20 areas or levels in order to do battle with the Gloire. Each level is defended by unique enemies like Feizel (a missile attack craft), Buluouwa

the most jaded player.

List Price: *Silpheed*, \$34.95. **Requires:** 512K RAM, DOS 2.0 or later. Copy protected through documentation. Sierra On-Line Inc., P.O. Box 485, Coarsegold, CA 93614; (209) 683-8989.

CIRCLE 406 ON READER SERVICE CARD

by
Bill Howard

Abort, Retry, Fail?

The Lighter Side of Personal Computing



CARTOON: RICHARD TENNANT

Desktop Publishing Market			
	1988	1988	1988
CPI	643.3	643.3	643.3
Software Packages	643.3	643.3	643.3

* Estimated U.S. Market in thousands of units

Desktop Publishing Software Leaders	
Company	Package
1. Software Publishing	PFS: First Publisher
2. Aldus	PageMaker
3. Xerox	Ventura Publisher
4. Aldus	PageMaker (Mac)
	Quark Set Go

"The desktop publishing market will grow at a rate of 28% a year for the next five years," says the December 25/January 1, 1990 issue of *Information Week*. Judging by the accompanying table, sales were flat in the period 1988 through 1988, however.

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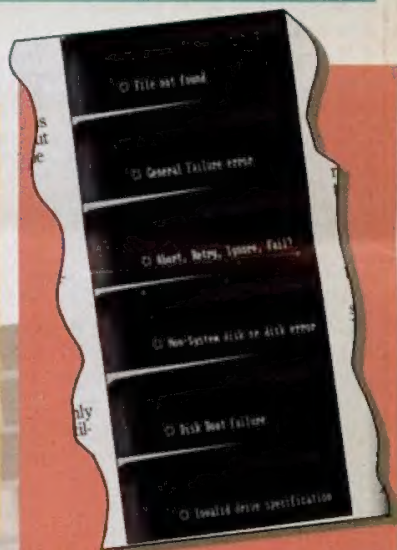
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Revealed: The Heretofore Unknown Relationship Between Mouse Resolution and Disk Space

"The resolution of the [Microsoft] Mouse 400 Series has been doubled from 200 to 400 points per inch. The increased resolution affords users more accuracy and control than was provided by previous versions. In addition, the mouse requires less disk space to move the cursor around the screen."

—Midrange Systems, November 28, 1989



Physician, heal thyself: Industry guru Peter Norton would be the first to notice what's wrong with the ad for his *Norton Utilities, Advanced Edition*: When the computer doesn't boot up, as in screens 4 and 5, you never get to the C> prompt. And (picky, picky) the other error messages should appear on lines above the C> prompts.

"SX Drive," "SX Appeal," "Safe SX"—sooner or later we knew someone would invoke one of the obvious puns. Here in *Inc.* magazine's January 1990 issue it's a company called DirectTech. Equally as interesting is the ad's positioning just above a Lifestyle Resource Co. ad for a pair of polished chrome spheres called, here at least, "Chinese Exercise Balls."

Paradox Department, 24-Pin Division

"Toshiba Demo Printer P351SX for sale. Never been used, \$750, cash only. (818) xxx-xxxx Chung."
—Classified ad, *Computer Marketplace* magazine, San Jose, Calif., November/December 1989

PC Magazine T-shirt and \$50 if we use your submission in Abort, Retry, Fail. Winners: Ron Herrman (Norton Utilities), David Knoblich (new mouse uses less disk space), your (SX drive), Rich Swan (unused demo machine), Abe Rosner (1988 DTP market).

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